



engineering and constructing a better tomorrow

September 9, 2008

Mr. James M. DiLorenzo  
Remedial Project Manager  
United States Environmental Protection Agency  
Office of Site Remediation and Restoration  
1 Congress Street, Suite 1100 (HB0)  
Boston, Massachusetts, 02114-2023

**Subject: DAPL Pilot Design Report  
Olin Chemical Superfund Site, Wilmington, Massachusetts**

Dear Mr. DiLorenzo:

On behalf of Olin Corporation, attached please find an electronic deliverable Design Report for the DAPL Extraction Pilot Test. This report is being submitted in accordance with the requirements specified in Sections II.B.3 of the Final Statement of Work (SOW) for the Olin Chemical Superfund Site. The SOW is incorporated by reference into the Administrative Settlement Agreement and Order of Consent for Remedial Investigation and Feasibility Study for the Olin Chemical Superfund Site, Wilmington, Massachusetts (USEPA CERCLA Docket No. 01-2007-0102).


The Design Report includes detailed drawings and specifications for construction of a truck loading facility as requested by USEPA on July 1, 2008. This design report has been submitted within the 45 day period required by EPA's August 6, 2008 approval of the Final Interim Response Steps Work Plan (IRSWP). Figure 1, attached, provides a schedule for the design, construction and implementation of the Pilot Test. The Pilot Test performance objectives and monitoring approach were provided in the IRSWP and the Performance Monitoring Program (PMP) submitted by Olin to the MADEP in December, 2004. A post test report will be submitted within 4 months of termination of the Pilot Test. Prior to start-up of the system an Operations and Maintenance Manual will be prepared which shall also incorporate the monitoring activities described previously in the PMP.

If you have any questions concerning this deliverable, please do not hesitate to contact Mr. Steve Morrow, Olin Corporation, at 423-336-4511.

Sincerely,

**MACTEC Engineering and Consulting, Inc.**

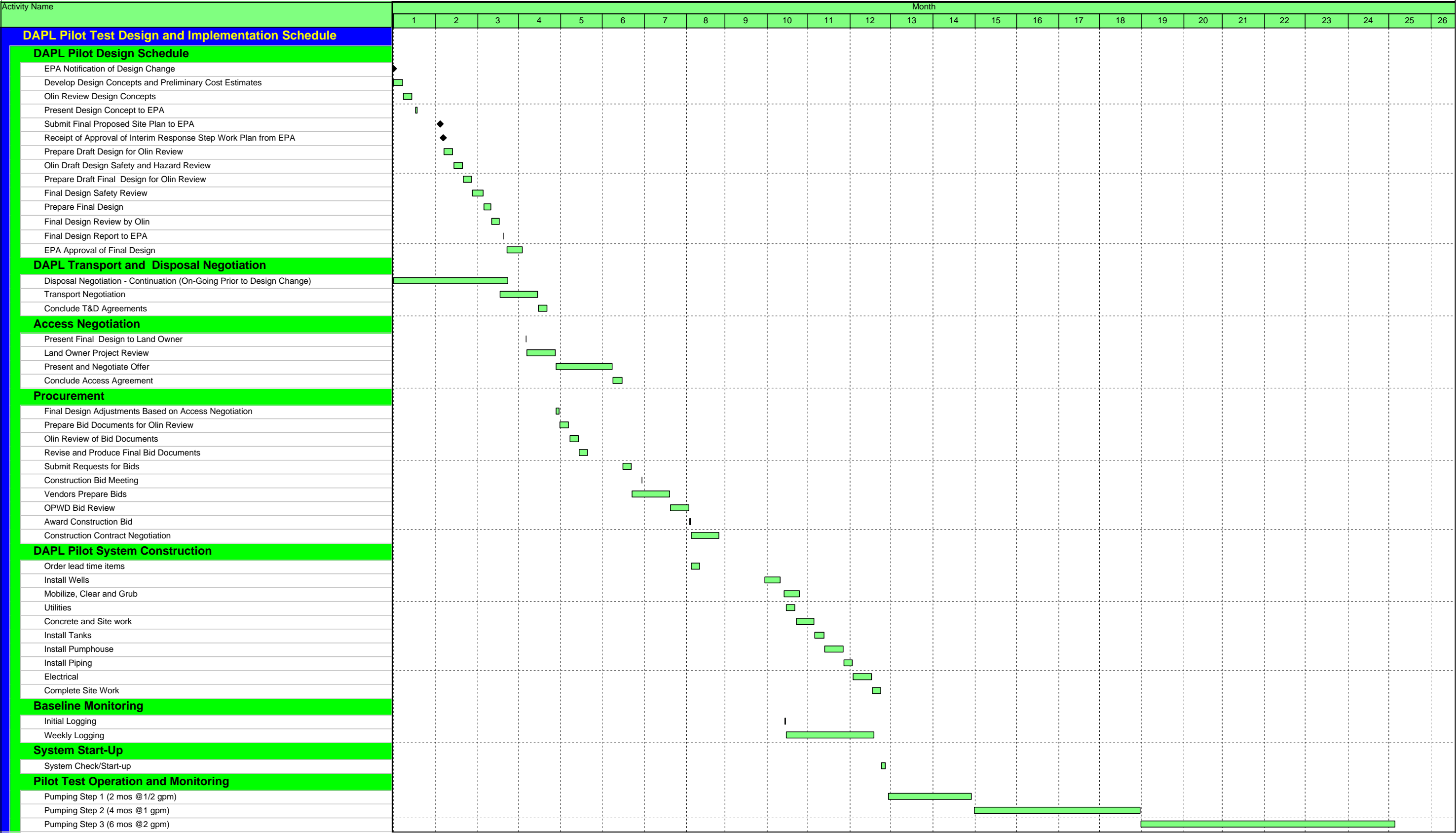
  
Peter H. Thompson  
Project Manager

  
Ralph E. Oulton  
Principal Engineer

Design Report Submitted Electronically  
cc: Joseph Coyne, MADEP  
Steve Morrow, Olin  
File

DAPL Pilot Test Design and Implementation Schedule

Months Since EPA Notification of Design Change



■ Activity  
 ◆ Milestone



6100080016/17

Prepared by: Rena Armstrong    Date: 9/8/08

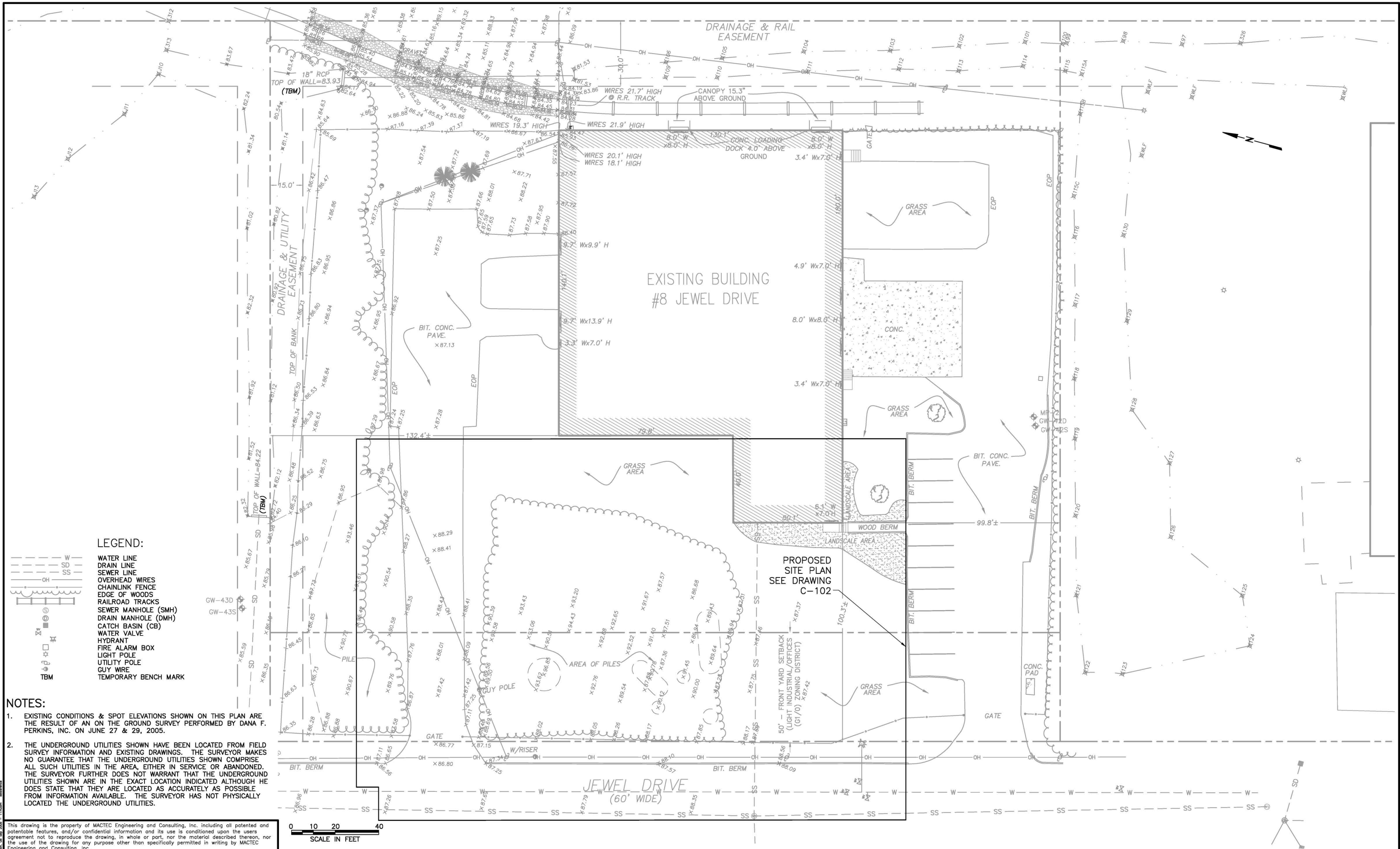
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Figure 1  
 DAPL Pilot Test Design & Implementation Schedule  
 Olin Chemical Superfund Site  
 Wilmington, Massachussetts

100% DESIGN EPA SUBMITTAL  
SEPTEMBER 2008

INCLUDED IN THIS SUBMITTAL	SHEET NUMBER	DRAWING TITLE	DISCIPLINE NUMBER
•	1	COVER SHEET	G-00
•	2	EXISTING SITE PLAN	C-101
•	3	PROPOSED SITE PLAN	C-102
•	4	CIVIL DETAILS	C-301
•	5	CIVIL DETAILS	C-302
•	6	CIVIL DETAILS	C-303
•	7	CONSTRUCTION SPECIFICATIONS	C-304
•	8	PIPING AND INSTRUMENTATION DIAGRAM	D-601
•	9	ELECTRICAL NOTES AND LEGEND	E-001
•	10	ELECTRICAL PLAN VIEWS	E-101
•	11	ELECTRICAL SPECIFICATIONS	E-102
•	12	ELECTRICAL HEATER SPECIFICATIONS AND SEQUENCE OF OPERATIONS	E-103
•	13	ELECTRICAL POWER WIRING	E-601
•	14	ELECTRICAL PANEL & LIGHT SCHEDULES	E-602

DRAWING NO:	G-001
1	14



- LEGEND:
- W WATER LINE
  - SD DRAIN LINE
  - SS SEWER LINE
  - OH OVERHEAD WIRES
  - CH CHAINLINK FENCE
  - EW EDGE OF WOODS
  - RT RAILROAD TRACKS
  - SMH SEWER MANHOLE (SMH)
  - DMH DRAIN MANHOLE (DMH)
  - CB CATCH BASIN (CB)
  - WV WATER VALVE
  - HYDRANT
  - FAB FIRE ALARM BOX
  - LP LIGHT POLE
  - UP UTILITY POLE
  - GW GUY WIRE
  - TBM TEMPORARY BENCH MARK

- NOTES:
- EXISTING CONDITIONS & SPOT ELEVATIONS SHOWN ON THIS PLAN ARE THE RESULT OF AN ON THE GROUND SURVEY PERFORMED BY DANA F. PERKINS, INC. ON JUNE 27 & 29, 2005.
  - THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES STATE THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

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A	08/05/08	ISSUED FOR CLIENT REVIEW - 45% DESIGN	MAP

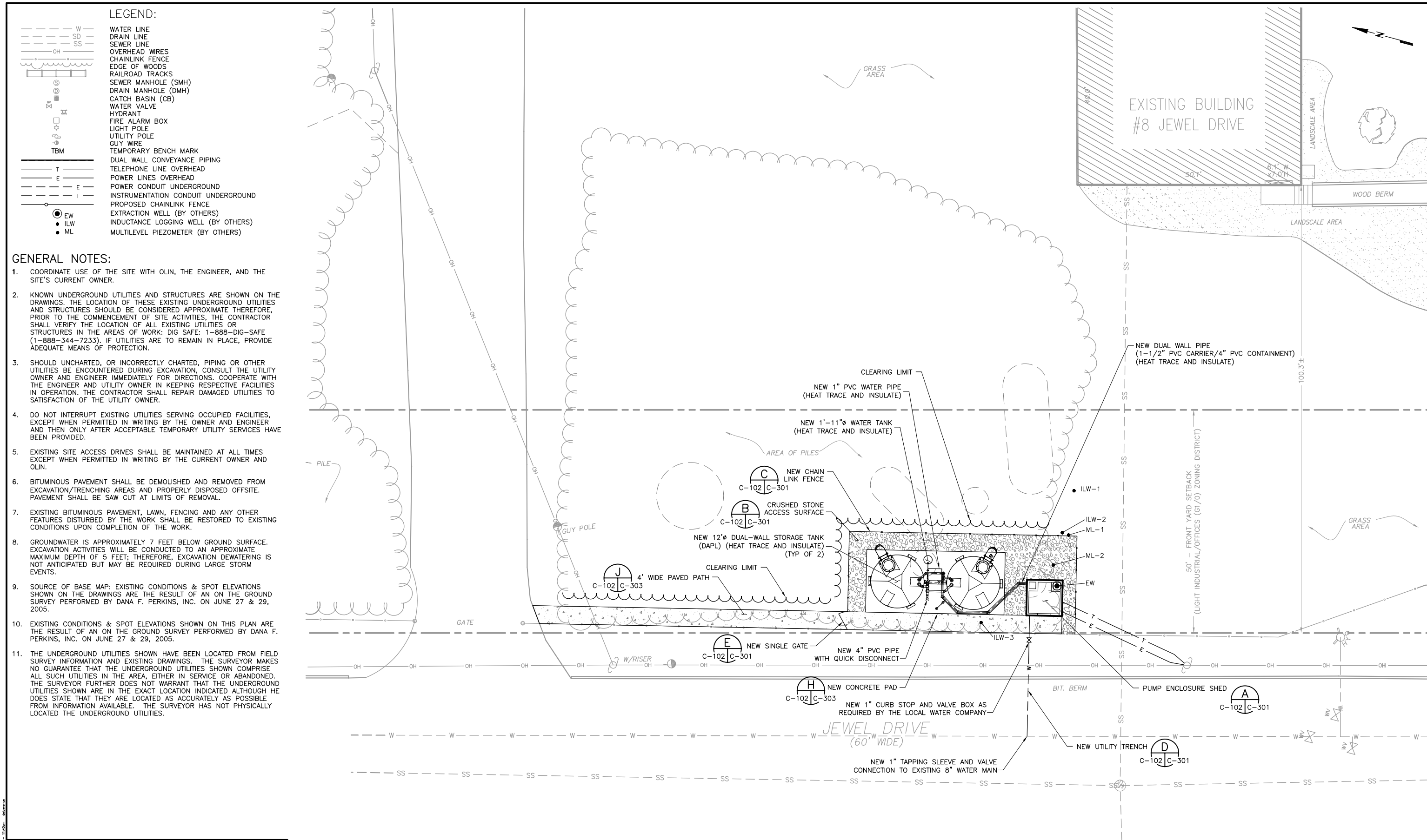


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DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

CML  
EXISTING SITE PLAN

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C-101  
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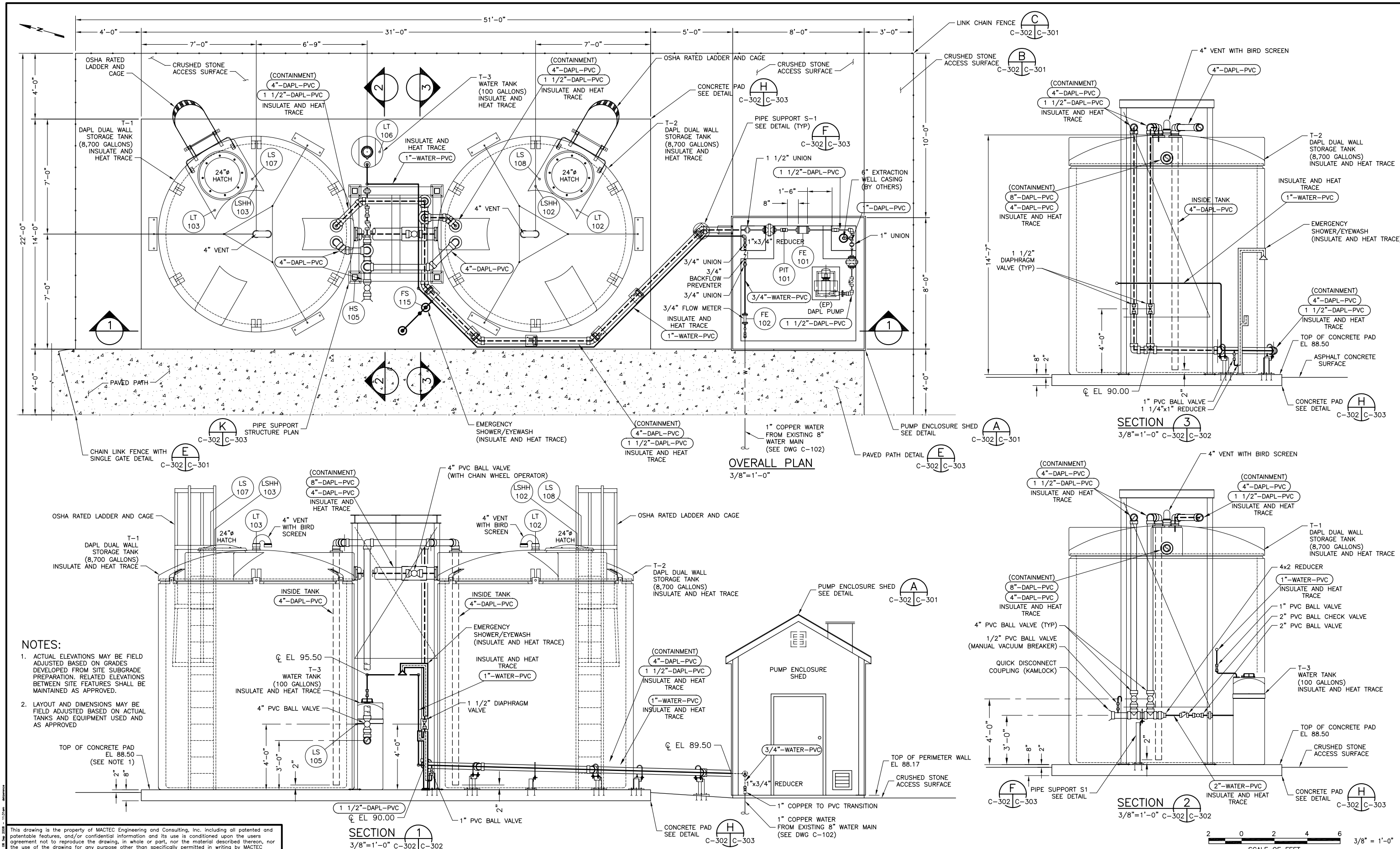
DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

CIVIL  
PROPOSED SITE PLAN

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C-102  
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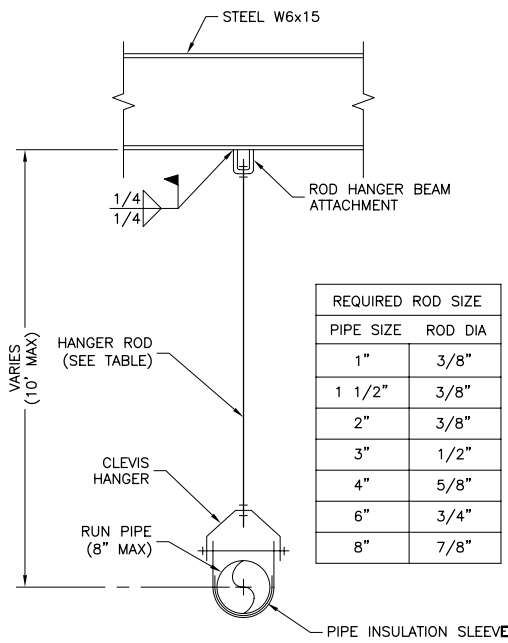
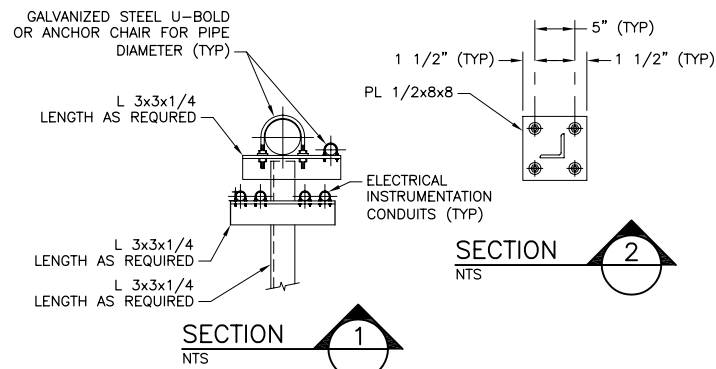


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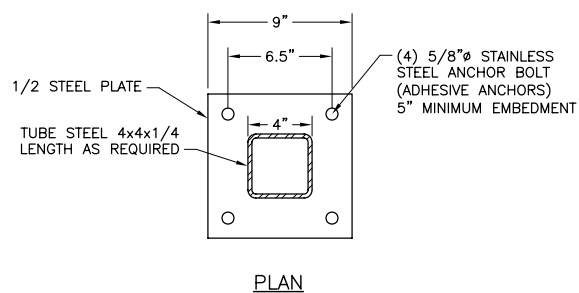
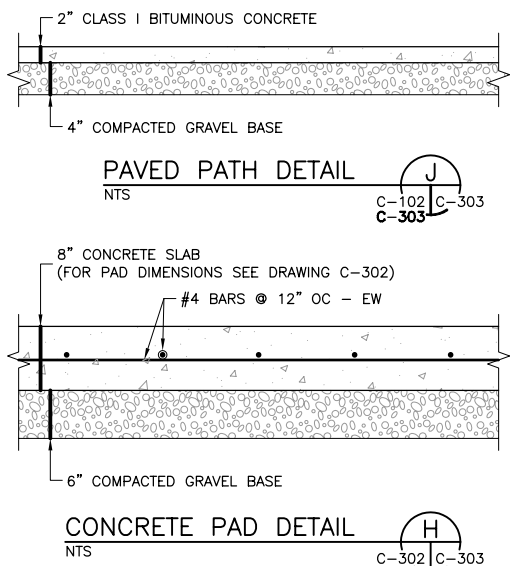
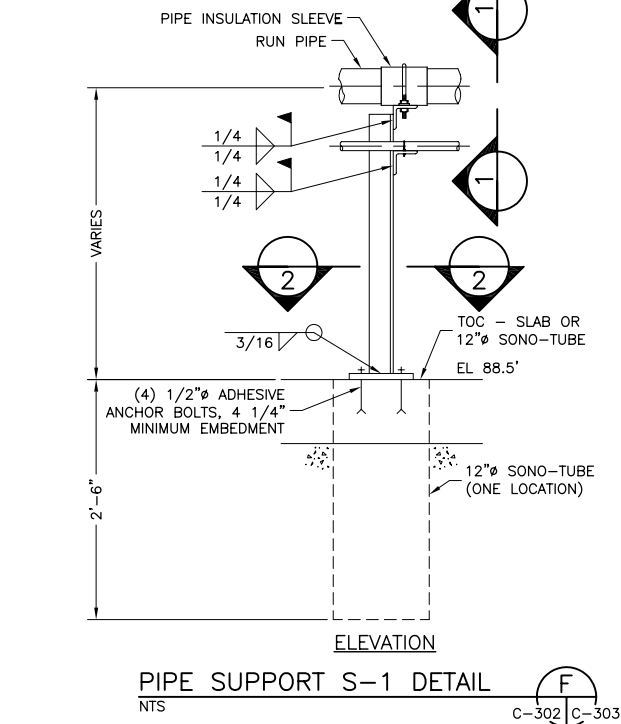
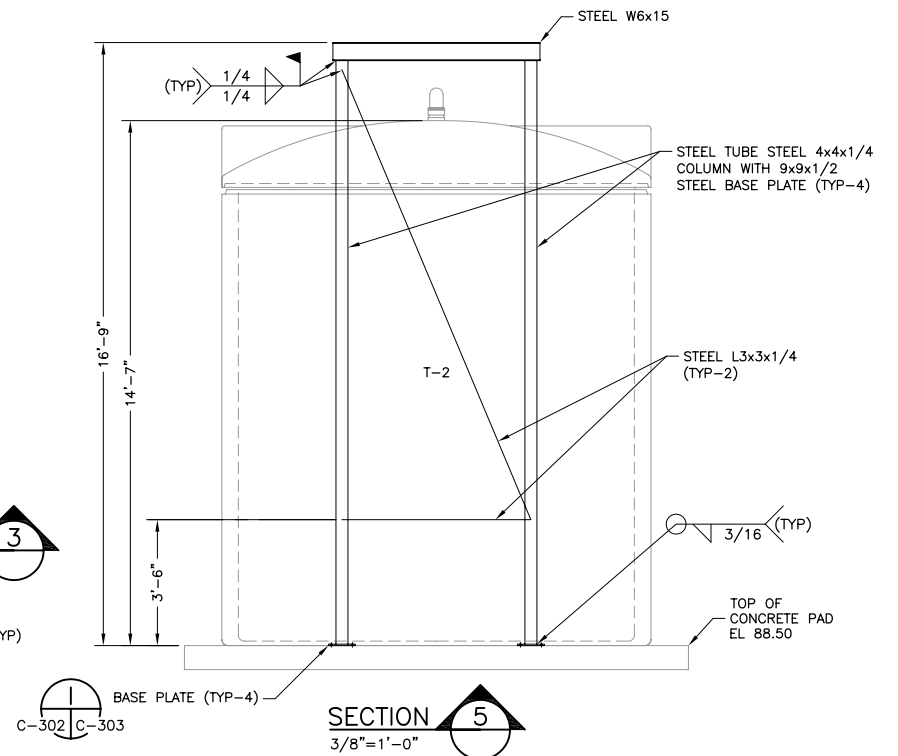
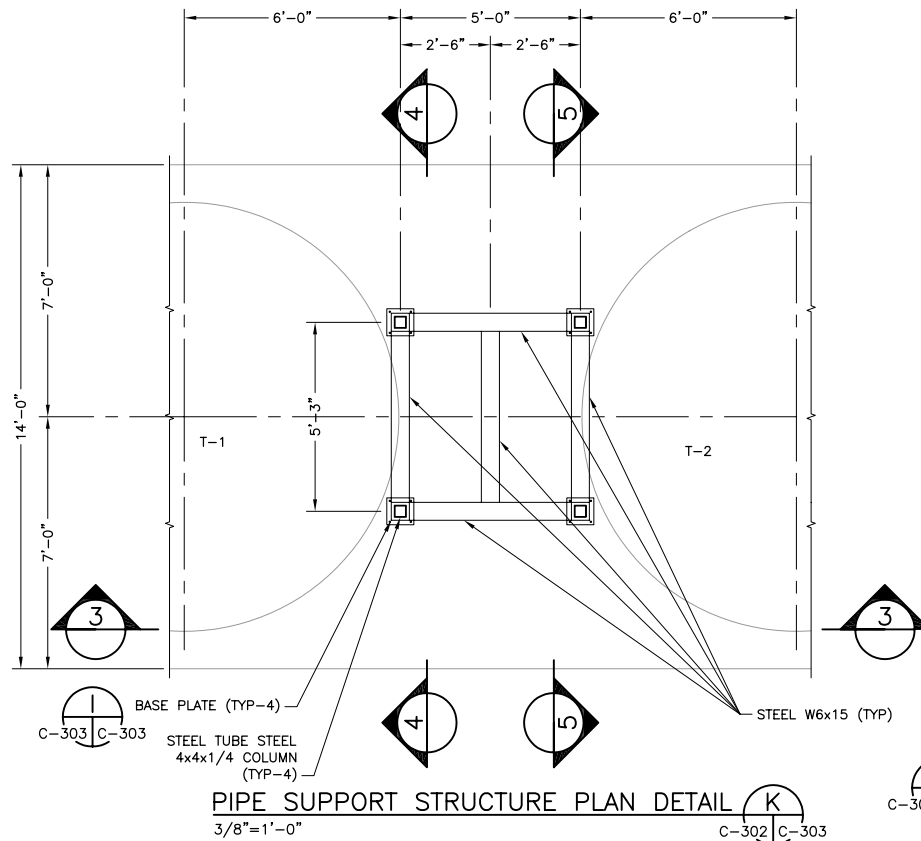
DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

CIVIL  
CIVIL DETAILS

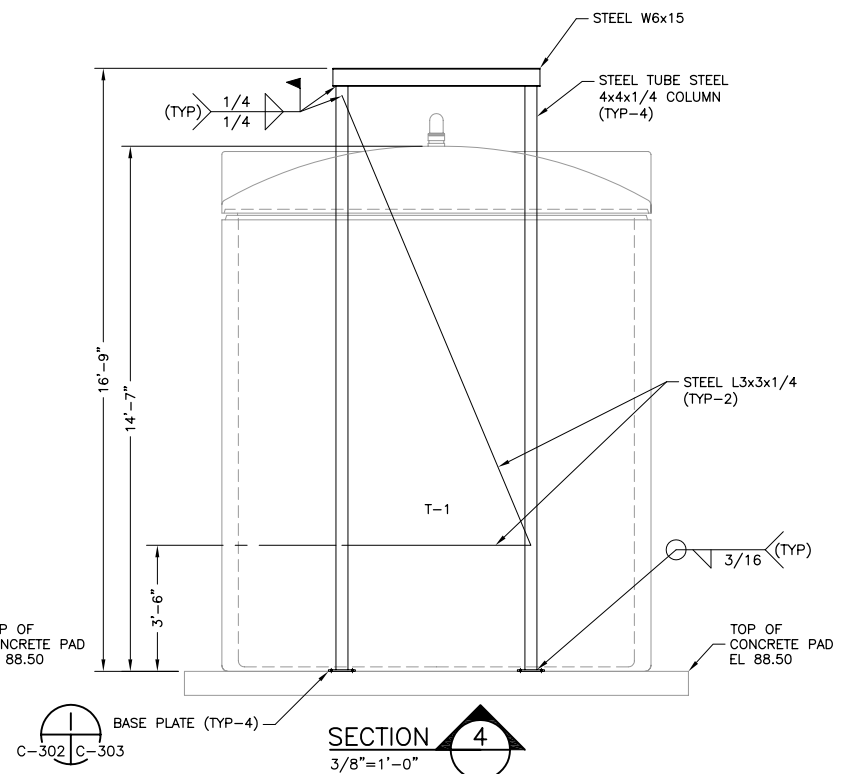
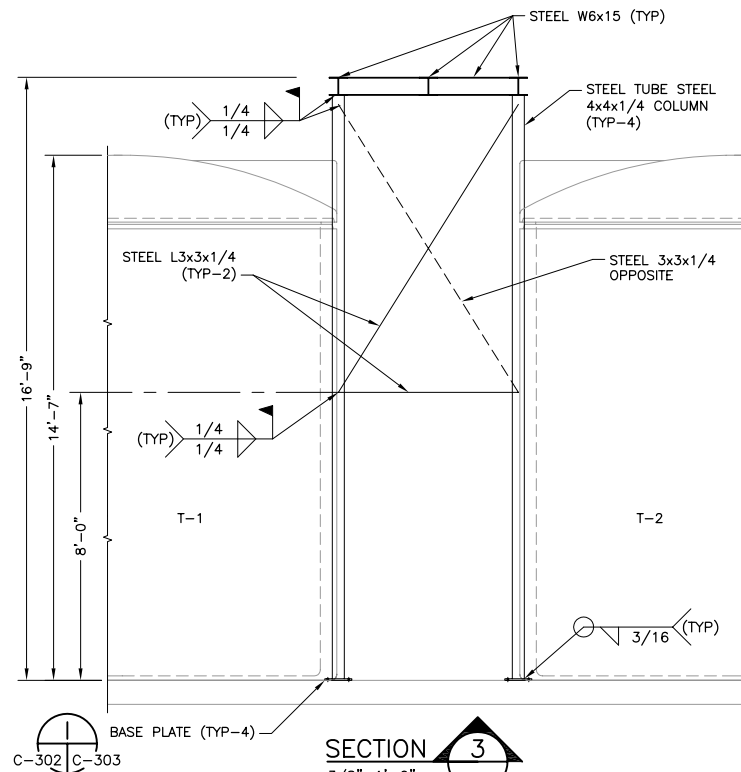
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REQUIRED ROD SIZE	
PIPE SIZE	ROD DIA
1"	3/8"
1 1/2"	3/8"
2"	3/8"
3"	1/2"
4"	5/8"
6"	3/4"
8"	7/8"



BASE PLATE DETAIL  
NTS  
C-102 C-303  
C-303



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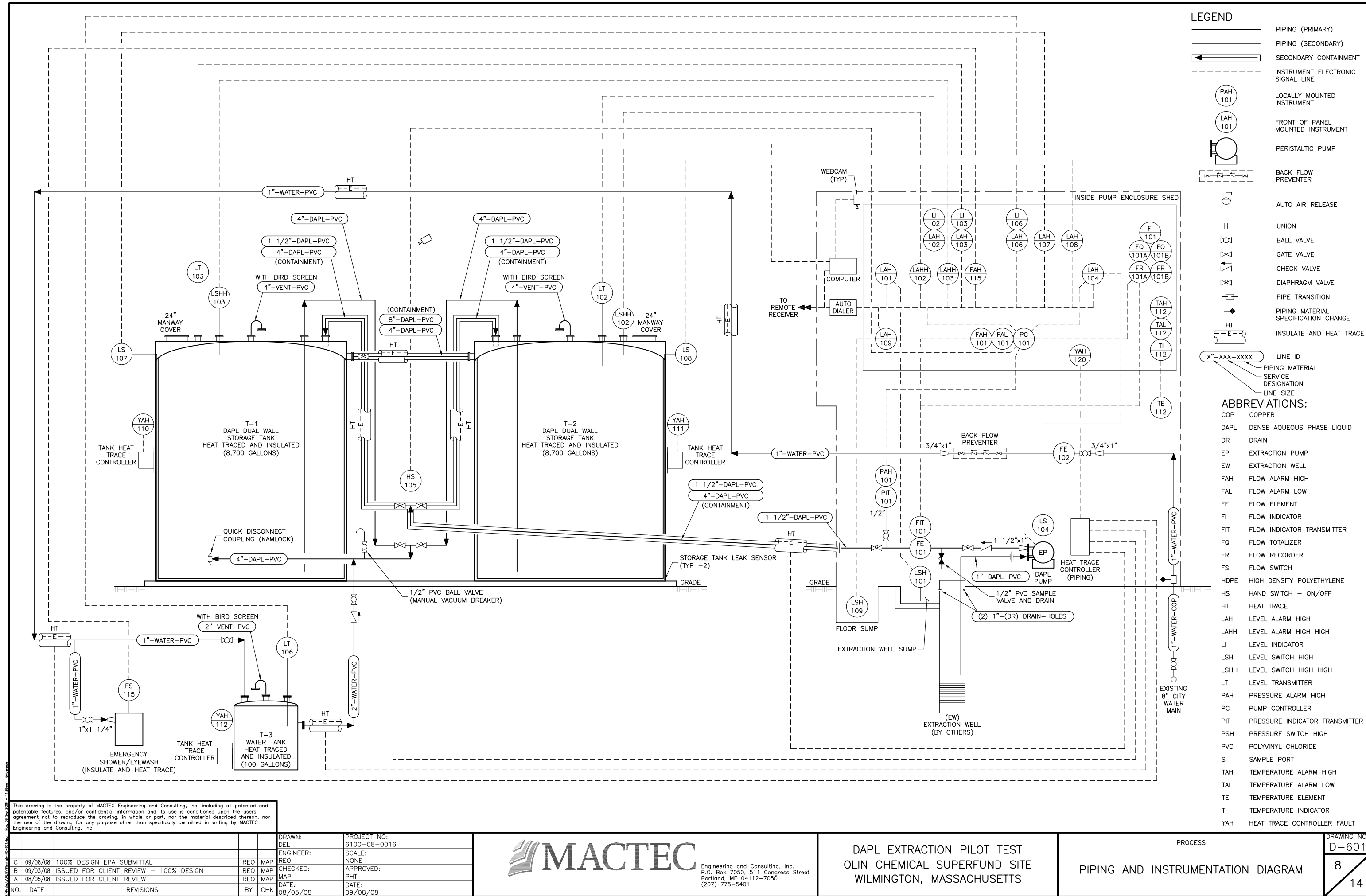
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14



CONSTRUCTION SPECIFICATIONS:									
BACKFILL AND COMPACTION									
1. GRAVEL BORROW AND GRAVEL BASE:									
<ul style="list-style-type: none"><li>MATERIAL – GRAVEL BORROW FOR FILL LOCATIONS OR GRAVEL BASE CONSTRUCTION SHALL BE MASSHIGHWAY M1.03.0 GRAVEL BORROW TYPE A, B, C, OR D. MATERIAL SHALL BE FREE OF TRASH, ICE, SNOW, TREE STUMPS, AND OTHER UNSUITABLE AND DELETERIOUS MATERIALS. IT SHALL BE OF SUCH A NATURE AND CHARACTER THAT IT CAN BE COMPACTED TO THE MINIMUM SPECIFIED DRY DENSITY INDICATED BELOW.</li><li>PLACEMENT – MAXIMUM 12-INCH LIFTS</li><li>COMPACTION – FOR BACKFILL MATERIALS PLACED IN VEGETATED AREAS, COMPACT TO A MINIMUM DENSITY OF 92% (MEASURED AS A PERCENTAGE OF THE MAX. DRY DENSITY AS DETERMINED BY ASTM D 698). FOR BACKFILL MATERIALS PLACED IN TRAFFIC AREAS UNDER PAVEMENT OR GRAVEL SURFACE, COMPACT TO A MINIMUM DENSITY OF 98%. IN PLACE DENSITY MAY BE DETERMINED BY DENSITY TESTING CONDUCTED AT A FREQUENCY OF 1 TEST (ASTM D 6938 – NUCLEAR GAUGE) PER LIFT PER 600 SF OR PER 200 LF OF TRENCH (MINIMUM 2 TESTS PER LIFT).</li><li>SUBMITTALS – FOR EACH SOURCE OF GRAVEL BORROW SUBMIT TO THE ENGINEER A GRAIN SIZE ANALYSIS (ASTM D 422) AND A MOISTURE–DENSITY CURVE (STANDARD PROCTOR – ASTM D 698).</li></ul>									
2. PIPE BEDDING:									
<ul style="list-style-type: none"><li>MATERIAL – USE GRAVEL BORROW MATERIAL EXCEPT MAXIMUM STONE SIZE SHALL BE ½-INCH.</li><li>PLACEMENT – MAXIMUM 6-INCH LIFTS</li><li>COMPACTION – SEE GRAVEL BORROW AND GRAVEL BASE.</li><li>SUBMITTALS – FOR EACH SOURCE OF PIPE BEDDING SUBMIT TO THE ENGINEER A GRAIN SIZE ANALYSIS (ASTM D 422) AND A MOISTURE–DENSITY CURVE (STANDARD PROCTOR – ASTM D 698).</li></ul>									
3. GRAVEL SURFACE:									
<ul style="list-style-type: none"><li>MATERIAL – MASSHIGHWAY M2.01.0 CRUSHED STONE CONFORMING TO M2.01.4, M2.01.5 OR M2.01.6 IN TABLE 1</li><li>PLACEMENT – ONE 4-INCH LIFT</li><li>COMPACTION – COMPACT TO A MINIMUM DENSITY OF 98%. IN PLACE DENSITY SHALL BE DETERMINED AS INDICATED UNDER GRAVEL BORROW AND GRAVEL BASE.</li><li>SUBMITTALS – FOR EACH SOURCE OF GRAVEL SURFACE MATERIAL SUBMIT TO THE ENGINEER A GRAIN SIZE ANALYSIS (ASTM D 422) AND A MOISTURE–DENSITY CURVE (STANDARD PROCTOR – ASTM D 698).</li></ul>									
ASPHALT									
1. PAVEMENT:									
<ul style="list-style-type: none"><li>MATERIAL – MASSHIGHWAY M3.11.00 CLASS I BITUMINOUS CONCRETE TYPE I–1. SURFACE OR FINAL COURSE USE M3.11.03 TABLE A TOP COURSE, DENSE MIX OR SURFACE TREATMENT. BASE COURSE USE M3.11.03 TABLE A BASE COURSE, BINDER COURSE OR DENSE BINDER COURSE.</li><li>PLACEMENT – THE BITUMINOUS CONCRETE MIXTURE SHALL NOT BE PLACED WHENEVER THE SURFACE IS WET OR FROZEN OR WHEN THE TEMPERATURE IS OUTSIDE THE LIMITATIONS STATED IN MASSHIGHWAY SECTION 460, UNLESS THE CONTRACTOR HAS A COLD WEATHER PAVING PROCEDURE APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE PROCEDURE AT LEAST ONE WEEK IN ADVANCE OF ANY PAVING OPERATIONS THAT MAY RESULT IN PLACEMENT OF THE BITUMINOUS CONCRETE PAVEMENT OUTSIDE OF THE TEMPERATURE LIMITATIONS STATED IN HIGHWAY SECTION 460. THE BITUMINOUS CONCRETE PAVEMENT SHALL BE PLACED IN TWO LIFTS (BINDER AND TOP COURSES). A THIN UNIFORM TACK COAT SHALL BE APPLIED PRIOR TO PLACEMENT OF THE TOP COURSE.</li><li>COMPACTION – NO COMPACTION TESTING IS REQUIRED, BUT THE BITUMINOUS CONCRETE PAVEMENT SHALL BE COMPACTED TO A SMOOTH FIRM FINISH AS DETERMINED BY CONTINUOUS OBSERVATION BY THE CONTRACTOR AND ENGINEER</li><li>SUBMITTALS – SUBMIT TO THE ENGINEER A JOB MIX FORMULA FOR EACH BITUMINOUS CONCRETE CLASS USED.</li></ul>									
STRUCTURAL STEEL									
1. PIPE SUPPORTS:									
<ul style="list-style-type: none"><li>STEEL – ASTM A36, ASTM A 500 AND/OR ASTM A 501</li><li>WELDS SHALL BE E70XX. IN ACCORDANCE WITH AWS D1.1</li><li>ANCHOR BOLTS – ADHESIVE ANCHORS, STAINLESS STEEL, ASTM A 307</li><li>FINISH – ONE COAT LATEX PRIMER AND TWO COATS LATEX FINISH TOP COAT (COLOR GRAY). PREPARATION OF SURFACE SHALL BE IN ACCORDANCE WITH SSPC SP–2, SP–3, SP–6, OR SP–7 AS REQUIRED FOR SURFACE CONDITION OF STEEL.</li><li>SUBMITTALS – FABRICATION DRAWINGS INCLUDING DESCRIPTION OF CONNECTIONS.</li></ul>									
CAST-IN-PLACE CONCRETE									
1. MIX:									
<ul style="list-style-type: none"><li>STRENGTH – MINIMUM 4000 PSI 28–DAY COMPRESSIVE STRENGTH.</li><li>WATER/CEMENT RATIO – MINIMUM 0.45.</li><li>SLUMP – 3 (±1) INCHES. MAXIMUM SLUMP MAY BE INCREASED ONE INCH FOR METHODS OF CONSOLIDATION OTHER THAN VIBRATION. SLUMP MAY BE INCREASED TO 7 INCHES WHEN SUPERPLASTICIZERS ARE USED</li><li>AIR ENTRAINMENT – 4 (±1.5) PERCENT. PROVIDE AIR ENTRAINMENT USING AIR–ENTRAINING ADMIXTURE</li><li>COARSE AGGREGATE – MAXIMUM NOMINAL AGGREGATE SIZE OF 1–1/2 INCHES (ASTM C 33 SIZE 57.</li><li>SUBMITTALS – . CONCRETE MIX DESIGN – TEN DAYS MINIMUM PRIOR TO CONCRETE PLACEMENT, SUBMIT A MIX DESIGN FOR EACH STRENGTH AND TYPE OF CONCRETE. SUBMIT A COMPLETE LIST OF MATERIALS INCLUDING TYPE, BRAND; SOURCE AND AMOUNT OF CEMENT, FLY ASH, POZZOLANS, GROUND SLAG, AND ADMIXTURES; AND APPLICABLE REFERENCE SPECIFICATIONS.</li></ul>									
2. CEMENT:									
<ul style="list-style-type: none"><li>ASTM C 150, TYPE I OR II OR ASTM C 595, TYPE IP(MS) OR IS(MS) BLENDED CEMENT EXCEPT AS MODIFIED HEREIN. THE BLENDED CEMENT SHALL CONSIST OF A MIXTURE OF ASTM C 150, TYPE II, CEMENT AND ONE OF THE FOLLOWING MATERIALS: ASTM C 618 POZZOLAN OR FLY ASH, ASTM C 989 GROUND IRON BLAST–FURNACE SLAG, THE POZZOLAN OR FLY ASH CONTENT SHALL NOT EXCEED 25 PERCENT BY WEIGHT OF THE TOTAL CEMENTITIOUS MATERIAL. THE GROUND IRON BLAST–FURNACE SLAG SHALL NOT EXCEED 50 PERCENT BY WEIGHT OF TOTAL CEMENTITIOUS MATERIAL. FOR EXPOSED CONCRETE, USE ONE MANUFACTURER FOR EACH TYPE OF CEMENT, GROUND SLAG, FLY ASH, AND POZZOLAN.</li></ul>									
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DATE: 08/05/08									
DATE: 09/08/08									
2. REINFORCEMENT:									
<ul style="list-style-type: none"><li>REINFORCING BARS: ACI 301 UNLESS OTHERWISE SPECIFIED. ASTM A 615/A 615M WITH THE BARS MARKED A, S, W, GRADE 60; OR ASTM A 996/A 996M WITH THE BARS MARKED R, GRADE 60</li><li>WELDED WIRE FABRIC: ASTM A 185 OR ASTM A 497. PROVIDE FLAT SHEETS OF WELDED WIRE FABRIC FOR SLABS AND TOPPINGS.</li></ul>									
4. SEALER/HARDENER:									
<ul style="list-style-type: none"><li>APPLY SEALER TO WELL ENCLOSURE SHED FLOOR AND SUMP SURFACES, SEALANT SHALL CONSIST OF A PENETRATING, PERMANENT SEALER PROVIDING CHEMICAL AND ACID RESISTANCE. USE MOXIE 1500 BY MOXIE INTERNATIONAL, DURO–NOX BY NOX CRETE™, OR APPROVED EQUAL.</li></ul>									
TOPSOIL AND VEGETATION									
1. TOPSOIL:									
<ul style="list-style-type: none"><li>MATERIAL – STRIP AND REUSE EXISTING TOPSOIL. IF ADDITIONAL TOPSOIL IS REQUIRED, OFFSITE MATERIAL SHALL BE A WELL–GRADED SOIL MATERIAL SUITABLE FOR THE FORMATION OF A SEED BED, SEED GERMINATION AND PLANT GROWTH. IT SHALL CONTAIN A MINIMUM OF 6% TO A MAXIMUM OF 20% ORGANIC MATTER AS REQUIRED BY LOSS–ON–IGNITION OF OVEN DRIED SAMPLES DRIED AT 105 DEGREES CENTIGRADE. IT SHALL ALSO POSSESS A PH RANGE OF 6.0–7.5 AND HAVE SOLUABLE SALTS NOT EXCEEDING 500 PPM. THE TOPSOIL SHALL BE FREE FROM REFUSE, STUMPS, ROOTS, BRUSH, WEEKS, ROCKS, AND STONES OVER 1 INCHES IN DIAMETER.</li><li>PLACEMENT – ONE 4-INCH LIFT.</li><li>COMPACTION – LIGHTLY COMPACT USING A HAND TAMPER.</li><li>SUBMITTALS – FOR OFFSITE TOPSOIL MATERIAL SUBMIT TO THE ENGINEER DATA CONFIRMING THE ORGANIC CONTENT OF THE SOIL, SOLUBLE SALT CONTENT AND PH.</li></ul>									
2. VEGETATION:									
<ul style="list-style-type: none"><li>SEED MIX – MASSHIGHWAY M6.03.0 SEED FOR GRASSPLOTS AND ISLANDS CONSISTING OF THE FOLLOWING: CREEPING RED FESCUE – 50%; KENTUCKY BLUE – 25%; DOMESTIC RYE – 10%; RED TOP 10%; LADINO CLOVER 5%.</li><li>PLACEMENT – 1.5 LB. PER 1000 SQUARE FEET.</li><li>SUBMITTALS – VENDOR INFORMATION INCLUDING SPECIES PRESENT IN THE SEED MIX, GERMINATION AND PURITY.</li></ul>									
PUMP ENCLOSURE SHED:									
1. CONSTRUCTION:									
<ul style="list-style-type: none"><li>STICK–BUILT OR PREFABRICATED WOOD CONSTRUCTION.</li><li>FRAMING – 2X4 AND/OR 2X6 AT A MINIMUM 16-INCHES O.C.</li><li>ROOFING – ½-INCH EXTERIOR PLYWOOD OR OSB SHEATHING AND 30–YEAR ASPHALT SHINGLES.</li><li>SIDING – ½-INCH EXTERIOR PLYWOOD OR OSB SHEATHING AND VINYL SIDING.</li><li>INSULATION – 3–1/2-INCH FIBERGLASS BATTING, R–11.</li><li>FLOOR – CONCRETE SLAB ON GRADE WITH 3-INCH HIGH CURB AROUND PERIMETER AND TWO FLOOR SUMPS WITH FIBERGLASS GRATING.</li><li>SUBMITTALS – SUBMIT VINYL SIDING STYLE, BRAND, AND COLOR FOR APPROVAL.</li></ul>									
2. ACCESSORIES:									
<ul style="list-style-type: none"><li>FOR EXHAUST VENT, EXHAUST FAN, AND INLET POWERED LOUVER, SEE DWG E–103.</li><li>DOOR – STANDARD EXTERIOR STEEL DOOR AND FRAME, 3'x6'–8". PERSONNEL (WALK) DOOR LEAVES SHALL BE FULL FLUSH HOLLOW METAL DOORS, 1–3/4 INCHES THICK WITH 20 GAUGE, GALVANIZED SKINS OVER A KRAFT HONEYCOMB CORE. LEAVES SHALL BE MANUFACTURED IN ACCORDANCE WITH SDI A250.8 LEVEL 1. PERSONNEL (WALK) DOOR FRAMES SHALL BE NON–HANDED (REVERSIBLE) FRAMES, 4–3/4 INCHES DEEP WITH A 2-INCH WIDE FACE, 16 GAUGE, GALVANIZED STEEL WITH SQUARE CUT, BUTTED CORNERS. DOORS AND FRAMES SHALL BE PROVIDED WITH A BAKED–ON PRIMER COAT.</li><li>DOOR HARDWARE: HARDWARE SHALL CONFORM TO BHMA A156.1, BHMA A156.2, BHMA A156.3, AND BHMA A156.4. DOORS SHALL BE PROVIDED WITH THE FOLLOWING HARDWARE:<ul style="list-style-type: none"><li>HINGES – 1–1/2 PAIR 4–1/2" X 4–1/2" PER BHMA A156.1 (630) SATIN STAINLESS FINISH WITH NON–RISING PINS.</li><li>THRESHOLD – 3–11/16" WIDE BY 5/8" HIGH EXTRUDED ALUMINUM.</li><li>WEATHERSTRIPPING – ¾" X ½" SILICON.</li><li>MORTISE CYLINDER LOCKSET – PER ANSI A156.13, SERIES 100, GRADE 1, FUNCTION F13, (626) SATIN CHROME FINISH.</li></ul></li><li>ROOF HATCH: BOX TYPE DESIGN WITH A MINIMUM 18-INCH SQUARE OPENING:<ul style="list-style-type: none"><li>ALUMINUM CURB AND COVER DESIGNED TO SUPPORT A LIVE LOAD OF 40 POUNDS/SF. PROVIDE 1-INCH FIBERGLASS INSULATION FOR COVER AND CURB. PROVIDE A CONTINUOUS WEATHER/DRAFT SEAL ATTACHED TO INSIDE OF COVER TO PROVIDE A FLUSH, TIGHT FIT.</li><li>OPENING – STEEL BUTT HINGES WITH BRASS PIN; FULLY ENCLOSED COMPRESSION SPRING OPERATOR AND AUTOMATIC HOLD OPEN ARM WITH GRIP RELEASE.</li><li>LATCH – PROVIDE SELF–LATCHING OUTSIDE TURN HANDLE WITH INSIDE LEVER HANDLE AND INSIDE PADLOCK PROVISION.</li><li>FINISH – ALUMINUM MILL FINISH.</li><li>SUBMITTALS – SUBMIT ROOF HATCH VENDOR DATA.</li></ul></li></ul>									
OTHER CONTRACTOR SUBMITTALS:									
1. VENDOR DATA ON FENCING AND GATES (SEE DRAWING C–302)									
2. PHOTOGRAPHIC SITE DOCUMENTATION PRIOR TO AND AFTER COMPLETION OF THE WORK									
DAPL STORAGE TANKS									
1. TANK									
<ul style="list-style-type: none"><li>WALL THICKNESS CALCULATED BASED ON A SPECIFIC GRAVITY OF 1.10 AND A HOOP STRESS OF 600 PSI @ 100°F. USING ASTM D 1998 REQUIREMENTS.</li><li>ROTATIONALLY–MOLDED, HIGH DENSITY CROSSLINKED POLYETHYLENE, DOUBLE WALL, FLAT BOTTOM TANKS WITH AN OXIDATION RESISTANT LINER SYSTEM.</li><li>EACH ASSEMBLY SHALL CONSIST OF A CYLINDRICAL, CLOSED TOP INNER PRIMARY TANK WITH A CAPACITY OF 8,700 GALLONS AND A CYLINDRICAL, OPEN TOP OUTER CONTAINMENT TANK.</li><li>ONE–PIECE SEAMLESS CONSTRUCTION.</li><li>DESIGN TO PREVENT RAINWATER FROM ENTERING THE CONTAINMENT TANK.</li><li>COVER DESIGNED WITH THICKNESS EQUAL TO THE THICKNESS OF THE TOP OF THE STRAIGHT SIDEWALL WITH AT LEAST 3 FLAT AREAS.</li><li>PROVIDE AT LEAST 3 LIFTING LUGS AND 3 CONCRETE SLAB ATTACHMENT LUGS.</li><li>OSHA DESIGNED FIBERGLASS LADDER WITH TANK AND SLAB ATTACHMENT HARDWARE WITH REQUIRED CAGES.</li><li>PROVIDE FITTINGS AND CONNECTIONS AS SHOWN ON THE DRAWINGS WITH EPDM GASKETS.</li><li>MINIMUM 24" DIAMETER MANWAY WITH AN EMERGENCY PRESSURE RELIEF DEVICE.</li><li>INTERNAL PIPING SHALL BE SUPPORTED FROM THE TANK WALL @ 6' MAXIMUM SPACING, AS MANUFACTURED BY POLY PROCESSING COMPANY, AND SHALL EXTEND TO WITHIN 2" OF TANK FLOOR.</li></ul>									
2. LEVEL INDICATION									
<ul style="list-style-type: none"><li>PROVIDE AN ULTRASONIC LEVEL TRANSMITTER SUITABLE FOR A NON–HAZARDOUS ENVIRONMENT.</li><li>DESIGNED FOR OUTSIDE LOCATIONS.</li><li>CAPABLE OF PROVIDING A 4–20 mA SIGNAL FOR REMOTE INDICATION (BY OTHERS).</li><li>POWER SUPPLY 110 VAC.</li></ul>									
3. LEAK DETECTION									
<ul style="list-style-type: none"><li>LEAK SENSOR SHALL BE A CAPACITIVE PROXIMITY SWITCH OF PP WITH A NEMA 4X RATING THAT OPERATES BETWEEN –13 AND 158°F.</li><li>POWERED BY 110 VAC.</li><li>SENSOR TO BE 34mm DIAMETER WITH VARIABLE SENSITIVITY ADJUSTMENT.</li><li>PROVIDE A LEAK DETECTION SYSTEM PANELFOR EACH OF THE DAPL TANKS SUITABLE FOR MOUNTING NEAR THE TANK ON A STAND PROVIDED BY THE TANK MANUFACTURER.</li><li>PROVIDE CONTACTS IN THE PANEL FOR REMOTE TRANSMISSION OF THE ALARM.</li><li>TO BE INSTALLED BY MANUFACTURER BETWEEN THE INNER AND OUTER TANK WALLS.</li><li>CABLE AND TANK WALL PENETRATION ASSEMBLY TO BE PROVIDED BY MANUFACTURER.</li></ul>									
4. HEATING SYSTEM									
<ul style="list-style-type: none"><li>POWER SUPPLY 110 VAC</li><li>ALUMINUM HEAT TAPE TO BE SIZED TO PROVIDE A ΔT OF 60°F FROM AMBIENT TEMPERATURE (MINIMUM SIZE PER TANK 2100 WATTS).</li><li>HEAT TAPE TO BE SIZED AND INSTALLED IN FACTORY BY TANK MANUFACTURER, PRIOR TO INSTALLATION OF THE 2" POLYURETHANE INSULATION.</li><li>SUPPLY HEATING SYSTEM CONTROLLER MOUNTED ON THE EXTERIOR OF EACH TANK, RATED NEMA 4, SUITABLE FOR NON–HAZARDOUS LOCATIONS.</li><li>PROVIDE AN OVER TEMPERATURE THERMOSTAT SET AT 150°F.</li></ul>									
5. SUBMITTALS – TANKS, LEVEL TRANSMITTER, LEAK DETECTION, AND HEATING SYSTEM FOR ALL THREE TANKS FOR MATERIALS, PRESSURE AND TEMPERATURE RATING, FUNCTION, AND OPERATION.									
WATER STORAGE TANK									
1. TANK									
<ul style="list-style-type: none"><li>MINIMUM SIZE OF 100 GALLONS (1'–11" DIAMETER).</li><li>ROTATIONALLY – MOLDED, HIGH DENSITY CROSS LINKED POLYETHYLENE, FLAT BOTTOM TANK.</li><li>PROVIDE CONNECTIONS WITH EPDM GASKETS AS SHOWN ON DESIGN DRAWINGS.</li><li>MINIMUM 2 LIFT LUGS AND 2 ANCHOR CONNECTIONS.</li></ul>									
2. LEVEL INDICATION									
<ul style="list-style-type: none"><li>PROVIDE AN ULTRASONIC LEVEL TRANSMITTER SUITABLE FOR A NON–HAZARDOUS ENVIRONMENT.</li><li>DESIGNED FOR OUTSIDE LOCATIONS.</li><li>CAPABLE OF PROVIDING A 4–20 mA SIGNAL FOR REMOTE INDICATION (BY OTHERS).</li><li>POWER SUPPLY 110 VAC.</li></ul>									
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PIPING AND VALVES									
1. BALL VALVES (PVC)									
<ul style="list-style-type: none"><li>PVC SIZED TO MATCH THE PIPING SHOWN ON THE DRAWINGS, TRUE UNION DESIGN, FULL PORT, ABS HANDLE, EPDM O–RINGS AND SEALS, TEFLON RENEWABLE SEAT, RATED 150 PSI AT 75°F WITH FLANGED ENDS.</li><li>BALL VALVES SHALL BE CAPABLE OF OPERATION BETWEEN 30°F AND 140°F.</li><li>THE VALVE SHALL BE EQUAL TO DUO BLOC TRUE UNION BALL VALVES MADE BY ASAHI/AMERICA OR APPROVED EQUAL.</li></ul>									
2. PINCH VALVES									
<ul style="list-style-type: none"><li>THE PINCH VALVES SHALL BE OPEN FRAME, MECHANICAL PINCH TYPE WITH FLANGED ENDS ON THE BODY AND SLEEVE TRIM.</li><li>THE SLEEVE SHALL HAVE 100% PORT FOR THE ENTIRE LENGTH OF THE SLEEVE AND BE VISIBLE WHILE BEING PINCHED IN ALL POSITIONS.</li><li>THE SLEEVE TRIM SHALL BE ONE PIECE EPDM WITH INTEGRAL FLANGES RETAINED BY THE FLANGE BOLTS. TABS SHALL ATTACH THE SLEEVE TO THE PINCH BAR.</li><li>THE STEEL PINCH MECHANISM SHALL BE DOUBLE ACTING. CAST PARTS ARE NOT ACCEPTABLE.</li><li>NON–RISING STEM AND HANDWHEEL.</li><li>EQUAL TO SERIES 70 MANUFACTURED BY RED VALVE CO, CARNEGIE, PA.</li></ul>									
3. CHECK VALVES									
<ul style="list-style-type: none"><li>PVC SIZED TO MATCH THE PIPING SHOWN ON THE DESIGN DRAWINGS, WITH PVC BALL.</li><li>EPDM SEATS AND SEALS RATED AT 150 PSI AT A TEMPERATURE OF 100°F.</li><li>SOCKET WELD ENDS.</li><li>RATED FOR FULL VACUUM SERVICE.</li><li>EQUAL TO TRUE UNION BALL CHECK VALVES MADE BY ASAHI/AMERICA OR APPROVED EQUAL.</li></ul>									
4. CARRIER PIPE									
<ul style="list-style-type: none"><li>PVC, SCH 80, SOLVENT WELDED PIPE.</li><li>FITTINGS SHALL BE FACTORY MADE WITH CARRIER PIPE PERMANENTLY ATTACHED TO THE CONTAINMENT PIPE READY FOR FIELD SOLVENT WELDING OF THE DOUBLE WALLED PIPING.</li><li>INSTALLED CARRIER PIPELINE SHALL BE PRESSURE TESTED AT 50 PSI FOR A 2 HOUR PERIOD WITH NO LEAKAGE. ANY LEAKAGE WILL BE REPAIRED AND RETESTED UNTIL NO LEAKAGE OCCURS DURING THE TEST PERIOD.</li></ul>									
5. CONTAINMENT PIPE									
<ul style="list-style-type: none"><li>SCHEDULE 40 PVC, SOCKET WELD PIPE.</li><li>PROVIDE FACTORY INSTALLED CENTRALIZERS.</li><li>PROVIDE A PVC STYLE B TERMINATION FITTING ON THE CONTAINMENT PIPE IN THE PUMP ENCLOSURE SHED LOCATED OVER THE PIPE ACCESS SUMP.</li><li>THE DAPL EXTERIOR PIPING SYSTEM WHERE INDICATED ON THE DESIGN DRAWINGS SHALL BE A DOUBLE CONTAINMENT PIPING SYSTEM EQUAL TO THE GUARDIAN SYSTEM MANUFACTURED BY IPEX, INC.</li></ul>									
6. PORTABLE WATER SYSTEM									
<ul style="list-style-type: none"><li>3/4"Ø RPZ BACKFLOW PREVENTER WITH DUAL CHECK VALVES CONSTRUCTED WITH SILICONE RUBBER DISK MATERIAL, POLYMER CHECK SEATS, STAINLESS STEEL RELIEF VALVE SEAT, AND STAINLESS STEEL COVER BOLTS SHALL BE EQUAL TO WATTS MODEL 009 QT. THE RPZ SHALL BE PROVIDED WITH 3/4"Ø QUARTER TURN, FULL PORT, RESILIENT SEATED BRONZE BALL SHUTOFF VALVES WITH NPT ENDS.</li><li>3/4"Ø FLOW METER (FE–102) EQUAL TO KRONE AQUAFLUX WITH CAST IRON HOUSING, TEFLON LINER, HASTALLOY C4 ELECTRODES, GROUNDING RINGS, AND ANSI B16.5 150 POUND FLANGES. PROVIDE LOCAL INDICATION AND TOTALIZING OR AS REQUIRED BY THE LOCAL WATER COMPANY.</li><li>BELOW GRADE PIPING SHALL BE MADE OF TYPE K COPPER TUBING. PIPING INSIDE THE PUMP ENCLOSURE SHED SHALL BE SOLVENT WELDED SCHEULE 80 PVC. EXTERIOR ABOVE GRADE WATER PIPING SHALL BE SCH 80 PVC, SOLVENT WELDED, HEAT TRACED, AND PROVIDED WITH 1" THICK INSULATION WITH ALUMINUM JACKET.</li><li>PROVIDE PIPE SUPPORTS AS REQUIRED FOR THE 3/4" WATER IN THE PUMP ENCLOSURE SHED.</li><li>PROVIDE PRESSURE TESTING TO MATCH THE CARRIER PIPE TESTING REQUIREMENTS.</li></ul>									
7. SUBMITTALS – VALVES AND PIPING FOR MATERIALS, PRESSURE RATING, FUNCTION, AND OPERATION.									
EXTRACTION PUMP									
1. PUMP									
<ul style="list-style-type: none"><li>CI PUMP WITH 316SS FRAME, FLANGES, CLAMPS, AND HARDWARE.</li><li>1" DIAMETER EPDM HOSE WITH 316SS INSERT MATERIAL.</li><li>EPOXY SHOES.</li><li>BUNA SEALS.</li><li>MAXIMUM CONTINUOUS OUTPUT 11 GPM AT 100 RPM. MINIMUM RATED DISCHARGE PRESSURE 200 PSI.</li><li>PUMP MODEL # SPX25 HOSE PUMP.</li><li>MANUFACTURER SHALL BE WATSON–MARLOW BREDEL.</li><li>1 HP TEFC MOTOR WITH 230V 1Ø POWER SUPPLY.</li></ul>									
2. CONTROLS									
<ul style="list-style-type: none"><li>PROVIDE A NEMA 4 CONTROL PANEL WITH A VARIABLE FREQUENCY DRIVE FOR MANUAL SPEED ADJUSTMENT. PANEL TO BE PROVIDED WITH A LOCAL KEYPAD CONTROL OF START, STOP, DIRECTION, SPEED CONTROL, AUTO/MANUAL, AND PROGRAMMING.</li><li>THE HIGH LEVEL HOSE LEAK SENSOR PROVIDED WITH THE PUMP SHALL BE CONNECTED TO THE PUMP CONTROL PANEL. AN OUTPUT SIGNAL FROM THIS SENSOR SHALL BE CONNECTED FROM THE PANEL TO THE AUTODIALER.</li><li>THE PUMP CONTROLS WILL BE SET TO STOP THE PUMP IF THE HOSE LEAK SENSOR IS ACTIVATED OR IF ANY OTHER EXTERNAL HIGH LEVEL SWITCHES ARE ACTIVATED. THE PUMP WILL BE MANUALLY RESTARTED AFTER A HIGH LEVEL SHUTDOWN.</li><li>SUBMITTALS – PUMP AND CONTROLS FOR PERFORMANCE, FUNCTION, MATERIALS, AND OPERATION.</li></ul>									
ALARMS									
1. ANNUNCIATOR									
<ul style="list-style-type: none"><li>VISUAL INDICATION OF ABNORMAL CONDITIONS AT THE FIELD SENSING LOCATIONS.</li><li>FLUSH PANEL MOUNTED SHX3W WITH INTEGRAL ACKNOWLEDGE, TEST PUSHBUTTON MODULE.</li><li>SELF–CONTAINED WITH INTEGRAL POWER SUPPLY AND FLASHER UNIT.</li><li>NOMINAL 1–3/8"x3" BACKLIGHTED WINDOWS.</li><li>ALARMS CAUSES FLASHING LAMP, ACKNOWLEDGE CAUSES STEADY LAMP, AND CLEARING ALARM RESETS THE ALARM POINT.</li><li>120VAC POWER AND INPUT FROM INDIVIDUALLY SELECTABLE NO OR NC TROUBLE CONTACTS.</li><li>PROVIDE SEPARATE SPDT OUTPUT TO ACTIVATE AUTODIALER SHOULD AN ALARM OCCUR.</li><li>MANUFACTURED BY RONAN, RILEY, OR ROCHESTER.</li><li>SUBMITTALS – FOR FUNCTION AND OPERATION.</li></ul>									
2. AUTOMATIC DIALING EQUIPMENT									
<ul style="list-style-type: none"><li>UNIT MONITORS ALARM AND WARNING TROUBLE CONTACTS AND CALLS PREDETERMINED TELEPHONE NUMBERS.</li><li>CAPABLE OF CALLING A MINIMUM OF 5 SUCCESSIVE NUMBERS UNTIL A CALL IS ANSWERED.</li><li>AFTER A CALL IS ANSWERED, THE UNIT WILL RESET AND BE READY FOR ANOTHER NEW INPUT.</li><li>PROVIDE A TIME DELAY ADJUSTMENT FROM 2 TO 90 SECONDS PRIOR TO ACTIVATING THE MESSAGE MOTOR. IF THE ALARM IS ACKNOWLEDGED DURING THE DELAY OR CALLING PROCESS, THE UNIT WILL RESET ITSELF TO THE FIRST NUMBER TO BE CALLED.</li><li>COMPATABLE WITH TELEPHONE COMPANY REQUIREMENTS.</li><li>EQUIP WITH BATTERIES AND A RECHARGING CIRCUIT POWERED BY 120VAC SUITABLE FOR ONE HOUR OF TAPE RECYCLING OR 8 HOURS IN STANDBY. INCLUDE A PILOT LIGHT TO INDICATE WHEN AC POWER IS ON.</li><li>MANUFACTURERS ARE ADCOR, ADEMCO, LSI, OR EQUAL.</li></ul>									
DRAWING NO: C–304									
DRAWING NO: 7									
DRAWING NO: 14									



ABBREVIATIONS

A	AMPERE	S	SIGNAL
AC	ALTERNATING CURRENT	SEC	SECONDARY
AD	AUTO DIALER	SHLD	SHIELDED CABLE
AFF	ABOVE FINISHED FLOOR	SOHE	SECONDARY OH ELECTRIC
AFG	ABOVE FINISHED GRADE	SV	SOLENOID VALVE
AIC	AMPERES INTERRUPTING CAPACITY	SW	SWITCH
ATC	AUTOMATIC TEMPERATURE CONTROL	SYM	SYMMETRICAL
ATS	AUTOMATIC TRANSFER SWITCH	T	TELEPHONE
AUX	AUXILIARY	TD	TELEDIALER
AWG	AMERICAN WIRE GAUGE	TDR	TIME DELAY RELAY
BKR	BREAKER	TEL	TELEPHONE
C	CONDUIT	TM	TELEMETRY
CB	CIRCUIT BREAKER	TS	TEMPERATURE SWITCH
CKT	CIRCUIT	TR	TRANSFORMER
CT	CURRENT TRANSFORMER	UG	UNDERGROUND
CU	COPPER	UPS	UNINTERRUPTED POWER SUPPLY
DC	DIRECT CURRENT	UT	UTILITY
DISC	DISCONNECT	V	VOLT
EG	EQUIPMENT GROUND	VA	VOLT-AMPERE
EH	ELECTRICALLY HELD	VFD	VARIABLE FREQUENCY DRIVE
EM	EMERGENCY	VM	VOLT METER
EMT	ELECTRICAL METALLIC TUBING	VR	VOLTAGE REGULATOR
EPR	ETHYLENE PROPYLENE RUBBER	W	WATT
EMH	ELECTRICAL MANHOLE	WH	WATT HOUR
EQUIP	EQUIPMENT	WP	WEATHERPROOF
ES	EMERGENCY STOP	XFMR	TRANSFORMER
EUH	ELECTRIC UNIT HEATER	XLP	CROSS LINKED POLYETHYLENE
EX	EXTERIOR	XP	EXPLOSION PROOF
EXTG	EXISTING		
FA	FIRE ALARM		
FC	FOOT-CANDLE		
FDR	FEEDER		
FLUOR	FLUORESCENT		
FS	FLOW SWITCH (FA SYSTEM)		
FVNR	FULL VOLTAGE NON REVERSING		
FVR	FULL VOLTAGE REVERSING		
GEN	GENERATOR		
GF	GROUND FAULT		
GFI	GROUND FAULT CIRCUIT INTERRUPTER		
GND	GROUND		
H	HAND HOLE		
HOA	HAND-OFF-AUTOMATIC		
HP	HORSE POWER		
HPS	HIGH PRESSURE SODIUM		
HT	HEAT TRACE		
HV	HIGH VOLTAGE		
HZ	HERTZ		
IG	ISOLATED GROUND		
JB	JUNCTION BOX		
KV	KILOVOLT		
KVA	KILO VOLT-AMPERE		
KW	KILOWATT		
KWH	KILOWATT HOUR		
LPS	LOW PRESSURE SODIUM		
LTG	LIGHTING		
LSH	LEVEL SWITCH HIGH		
LV	LOW VOLTAGE		
MCB	MAIN CIRCUIT BREAKER		
MCC	MOTOR CONTROL CENTER		
MCP	MOTOR CIRCUIT PROTECTION		
MDP	MAIN DISTRIBUTION PANEL		
MH	METAL HALIDE		
MOD	MOTOR OPERATED DAMPER		
MS	MANUAL STARTER OIL/RIL		
MTS	MANUAL TRANSFER SWITCH		
MVA	MEGAVOLT-AMPERE		
OH	OVERHEAD		
OIT	OPERATOR INTERFACE TERMINAL		
OL	OVER LOAD		
OOA	ON-OFF-AUTOMATIC		
P	POLE		
PB	PUSH BUTTON		
PF	POWER FACTOR		
PH	PHASE		
PNL	PANEL		
POHE	PRIMARY OH ELECTRIC		
PRI	PRIMARY		
PT	POTENTIAL TRANSFORMER		
PVC	POLYVINYL CHLORIDE		
RGSC	RIGID GALVANIZED STEEL CONDUIT		
RVSS	REDUCED VOLTAGE SOLID STATE		
RSC	RIGID STEEL CONDUIT		

DESCRIPTION
200/3 UNFUSED SAFETY SWITCH, RATING AS NOTED
POLES
AMPERES
30/15/3 FUSED SAFETY SWITCH, RATING AS NOTED
POLES
FUSE AMPERE RATING
SWITCH AMPERE RATING
1 MAGNETIC MOTOR STARTER, RATING AS NOTED
NEMA SIZE
COMBINATION TYPE MAGNETIC MOTOR STARTER, RATING AS NOTED
PUSHBUTTON OR SELECTOR SWITCH STATION
EMERGENCY STOP P.B.
SOLENOID
RELAY
MOD MOTOR OPERATED DAMPER
C LIGHTING OR POWER CONTACTOR
CB ENCLOSED CIRCUIT BREAKER
T THERMOSTAT
C COOLING ONLY
F FREEZESTAT
D DUCT-MOUNTED
UTILITY METER
PANELBOARD, SURFACE MTD.
PANELBOARD, FLUSH MTD.
EQUIPMENT, TERMINAL, OR CONTROL CABINET
5 THREE PHASE MOTOR (HP AS SHOWN)
SINGLE PHASE MOTOR
T TRANSFORMER
▲ PAD MOUNTED TRANSFORMER
EW H ELECTRIC WATER HEATER
H ELECTRICAL HANDHOLE
J JUNCTION BOX
PS PRESSURE SWITCH
E ELECTRIC ACTUATED VALVE
MS MANUAL MOTOR STARTER, OL, RIL
FRACTIONAL HP

SINGLE LINE DIAGRAM

DESCRIPTION
Ⓐ AMMETER
Ⓥ VOLTMETER
TRANSFORMER
CT CURRENT TRANSFORMER
PT POTENTIAL TRANSFORMER
100AF FRAME SIZE
70AT CIRCUIT BREAKER
TRIP AMPS
SURGE CAPACITOR
LIGHTNING ARRESTER
COMBINATION MOTOR STARTER AND BREAKER
AUTOTRANSFORMER-TYPE MOTOR STARTER
REVERSING MOTOR STARTER
TWO-SPEED TWO-WINDING MOTOR STARTER
REDUCED VOLTAGE SOLID-STATE MOTOR STARTER
Δ DELTA CONNECTION
WYE CONNECTION
GROUND CONNECTION
GENERATOR
ES EMERGENCY STOP MUSHROOM SWITCH (RED) LOCKABLE

LIGHTING FIXTURES

FLUORESCENT FIXTURE, TROFFER TYPE
LETTER INDICATES FIXTURE TYPE (TYP.)
FLUORESCENT FIXTURE, STRIP OR WRAPAROUND TYPE
INCANDESCENT WALL MOUNTED FIXTURE
INCANDESCENT CEILING FIXTURE
H.I.D. WALL MOUNTED FIXTURE
H.I.D. CEILING FIXTURE
EXIT SIGN (ARROW INDICATES FACES)
EMERGENCY LIGHTING BATTERY UNIT WITH 2 LAMP HEADS
REMOTE EMERGENCY LIGHTING LAMP HEAD (2)
POLE MOUNTED SITE LIGHT

WIRING

OHE OVERHEAD ELECTRICAL WIRING, CONCEALED IN FINISHED AREAS, EXPOSED WHERE PERMITTED BY SPECIFICATIONS
WIRING INSTALLED IN OR BELOW FLOOR SLAB
LP1/2 HOME RUN TO PANEL (CKT. NO. AS SHOWN)
HOME RUN (NO. REFERS TO COND. & WIRE SCHED.)
DC DC WIRING
3C#12 W/GND, 1°C WIRE & CONDUIT
CONDUIT DOWN
CONDUIT UP
US UNSWITCHED

WIRING DEVICES

DESCRIPTION
20 AMPERE, 120 VOLT DUPLEX RECEPTACLE
+48" INDICATES INCHES AFF MOUNTING HEIGHT
WP WEATHERPROOF
GFI GROUND FAULT INTERRUPTER
IG ISOLATED GROUND
20 AMPERE, 120 VOLT QUAD RECEPTACLE
20 AMPERE, 120 VOLT SINGLE RECEPTACLE
W TELEPHONE OUTLET, +18" AFF WALL MOUNTED, +54" AFF
30 SINGLE SPECIAL PURPOSE RECEPTACLE
INDICATES AMPERE SIZE
TD TELEPHONE & DATA
TELEPHONE EXTENSION RINGER DEVICE
S SINGLE POLE WALL SWITCH
DP DOUBLE POLE SWITCH
3 THREE WAY SWITCH
4 FOUR WAY SWITCH
P NEON PILOT LIGHT
WP WEATHERPROOF
K KEY OPERATED
EX EXPLOSION PROOF
D DIMMER SWITCH
T MOTOR RATED

SCHEMATIC DIAGRAM

CR CONTROL RELAY
M MOTOR CONTACTOR
CONTACT NORMALLY OPEN
CONTACT NORMALLY CLOSED
OVERLOAD HEATER ELEMENT
SINGLE POLE SINGLE THROW SWITCH
SELECTOR SWITCH
START PUSHBUTTON, MOMENTARY CONTACT
STOP PUSHBUTTON, MOMENTARY CONTACT
RED MUSHROOM-HEAD MAINTAINED-TYPE EMERGENCY STOP PUSHBUTTON
LIMIT SWITCH
TEMPERATURE SWITCH
FLOAT SWITCH
PRESSURE SWITCH
TIMED CONTACT
PILOT LIGHT, LETTER INDICATES COLOR
G GREEN
R RED
A AMBER

NEMA CLASSIFICATIONS FOR ELECTRICAL

EQUIPMENT AND ENCLOSURES

(UNLESS OTHERWISE NOTED OR SPECIFIED)

LOCATION	CLASSIFICATION
EXTERIOR POWER	NEMA 3R
INTERIOR POWER	NEMA 1

ELECTRICAL DRAWING INDEX

E-001	NOTES AND LEGEND
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E-103	HEATER SPECIFICATIONS AND SEQUENCE OF OPERATIONS
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E-602	PANEL AND LIGHT SCHEDULES

GENERAL NOTES

- ALL CONDUIT AND EQUIPMENT SHALL BE INSTALLED AND GROUNDED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE CURRENT NATIONAL ELECTRICAL CODE.
- CONDUIT RUNS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURES. CONDUITS SHALL BE CONCEALED IN WALLS, AND ABOVE ANY SUSPENDED CEILINGS WHERE APPLICABLE. EXPOSED CEILING CONDUITS SHALL BE PERMITTED WHERE SUSPENDED CEILINGS ARE NOT USED. EXPOSED CONDUITS SHALL BE INSTALLED PARALLEL TO BEAMS AND WALLS.
- CONDUITS SHALL BE PROPERLY TERMINATED WITH NEAT CONNECTIONS TO ALL ASSOCIATED EQUIPMENT.
- CONTROL AND INSTRUMENTATION CONDUIT SIZES AND NUMBER OF CONDUCTORS ARE TO BE DETERMINED FROM SCHEMATIC DIAGRAMS, INSTRUMENTATION DIAGRAMS, AND/OR SPECIFICATIONS, IF NOT DIRECTLY SHOWN ON POWER PLANS. THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL AND INSTRUMENTATION EQUIPMENT. MODIFICATIONS REVIEWED BY THE ENGINEER WITH NO EXCEPTIONS TAKEN, MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND SPECIFICATIONS. EACH CONTROL AND INSTRUMENTATION CONDUIT SHALL ALSO CONTAIN 10 PER CENT SPARE CONDUCTORS, WITH A MINIMUM OF TWO SPARES, UP TO THE LIMIT OF CONDUIT FILL AS SPECIFIED BY THE NATIONAL ELECTRICAL CODE. INSTRUMENTATION SHIELDED CABLES SHALL BE INSTALLED IN RGS CONDUIT SEPARATE FROM OTHER POWER WIRING. PVC IS ALLOWED FOR INSTRUMENTATION UNDERGROUND.
- EACH CONDUIT TO CARRY GROUND WIRE(S) ACCORDING TO NATIONAL ELECTRIC CODE IN ADDITION TO NUMBER OF CONDUCTORS SHOWN ON DRAWINGS OR PER NOTE 4 ABOVE. ALL GROUNDING MUST CONFORM TO ARTICLE 250 OF CURRENT NATIONAL ELECTRICAL CODE.
- MINIMUM CONDUIT SIZE SHALL BE 3/4". MINIMUM POWER WIRING SHALL BE 2C#12 AWG WITH GROUND, AND 2C#14 FOR CONTROL. INSTRUMENTATION CABLE SHALL BE 2C#16 TWS AND 3C#16 TWS FOR SPEED POTENTIOMETER INSTALLED PER NEC. PROVIDE CONDUIT AND WIRING AS INDICATED.
- ALL PANELBOARDS SHALL BE MOUNTED SO THAT THE DISTANCE FROM THE TOP CIRCUIT BREAKER OPERATING HANDLE TO FINISHED FLOOR SHALL NOT EXCEED 6'-6".
- ALL SURFACE MOUNTED PANELS AND PANELBOARDS ON THE INSIDE OF EXTERIOR WALLS ABOVE GRADE, OR IN OTHER LOCATIONS CONSIDERED AS DAMP, SHALL BE MOUNTED TO MAINTAIN A 1/4" AIR SPACE BETWEEN THE ENCLOSURE AND THE WALL.
- ELECTRICAL EQUIPMENT LOCATIONS ARE APPROXIMATE ONLY. COORDINATE LOCATIONS WITH PROCESS PIPING, ARCHITECTURAL, STRUCTURAL, AND MECHANICAL DRAWINGS. CONTRACTOR SHALL COORDINATE MANUFACTURERS EQUIPMENT REQUIREMENTS WITH SPACE AVAILABLE. FINAL CONTROL PANEL LOCATIONS SHALL BE FIELD COORDINATED.
- ALL FIELD CONTROL CONDUCTORS WILL TERMINATE AT INDIVIDUAL TERMINAL BLOCKS WITHIN THE CONTROL ENCLOSURE. SERIES AND PARALLEL CONNECTION OF FIELD CONTROL CONDUCTORS WILL BE MADE ONLY AT CONTROL PANEL OR MOTOR CONTROL CENTER TERMINAL BLOCKS.
- GROUND ALL CONDUCTOR SHIELDS AT PANEL ONLY - DO NOT GROUND SHIELDS AT BOTH ENDS.
- AT THE FOLLOWING LOCATIONS, UNLESS OTHERWISE NOTED, PULL, JUNCTION, TERMINAL, SWITCH, AND OUTLET BOXES SHALL BE CAST IRON WHERE STEEL CONDUIT IS TERMINATED; OR SHALL BE CAST ALUMINUM WHERE ALUMINUM CONDUIT IS TERMINATED:  
A - AT LOCATIONS WHERE VAPORTIGHT LIGHTING FIXTURES AND/OR WATERTIGHT RECEPTACLES ARE INDICATED.  
B - AT LOCATIONS ON OR IN ALL OUTSIDE WALLS.  
C - OUTDOORS
- NAMEPLATES SHALL CONFORM STRICTLY TO INSTRUCTIONS IN THE ELECTRICAL SPECIFICATIONS AND ON THE DRAWINGS. THE FOLLOWING SHALL HAVE NAMEPLATES:  
A - ALL MAIN BREAKERS AND TIE BREAKERS.  
B - ALL COMPARTMENTS OF MOTOR CONTROL CENTERS EXCLUDING UNUSED COMPARTMENTS.  
C - ALL LOCAL CONTROL STATIONS AT OR NEAR EQUIPMENT.  
D - ALL PANELBOARDS.  
E - GANGED LIGHT SWITCHES.
- PIPE SLEEVES FOR CONDUITS PASSING FROM NON-HAZARDOUS AREAS TO HAZARDOUS AREAS SHALL HAVE CAULKING APPLIED TO MAKE THE INSTALLATION GASTIGHT.
- COORDINATE ELECTRICAL DEVICES WITH LAB EQUIPMENT AND FURNITURE ARRANGEMENT, WHERE APPLICABLE.
- COORDINATE ELECTRICAL DEVICES WITH OFFICE/KITCHEN EQUIPMENT ARRANGEMENT, WHERE APPLICABLE.
- CONTRACTOR SHALL PROVIDE ALL DISCONNECTS AND SERVICE RECEPTACLES FOR HVAC AS REQUIRED BY NEC.
- CONTRACTOR SHALL PROVIDE ALL CONDUIT, WIRING, EQUIPMENT, AND CONTROL DEVICES AS INDICATED BY SCHEMATICS, SINGLE LINE DIAGRAMS, SCHEDULES, PLANS, SPECIFICATIONS, AND VENDOR DOCUMENTATION TO PROVIDE A COMPLETE WORKING SYSTEM.
- PROVIDE CONDUIT FREEZE EXPANSION FITTINGS FOR ALL EXTERIOR CONDUIT SYSTEMS AS REQUIRED.
- EXACT NUMBER, LOCATION, HORSEPOWER, VOLTAGE, AND PHASE OF ALL MOTORS AND DEVICES ASSOCIATED WITH THE PROCESS EQUIPMENT, HVAC EQUIPMENT, AND OTHER EQUIPMENT SYSTEMS, AS APPLICABLE, PROVIDED UNDER THIS CONTRACT SHALL BE COORDINATED WITH THE ACTUAL EQUIPMENT SUPPLIER. CONDUIT AND WIRING TO BE PROVIDED SHALL BE ADJUSTED ACCORDINGLY AT NO ADDITIONAL COST TO THE OWNER. CONDUCTORS FROM VFD CONTROLLERS TO MOTOR SHALL BE IN RGS.
- PROVIDE CONCRETE HOUSEKEEPING PADS (4" HIGH) UNDER FLOOR MOUNTED ELECTRICAL AND INSTRUMENTATION EQUIPMENT. PROVIDE SUBMITTAL SKETCH FOR ENGINEER REVIEW.
- CONTRACTOR SHALL PROVIDE A COMPLETE WORKING OPERATING SYSTEM IN ACCORDANCE WITH ALL DRAWINGS, SPECIFICATIONS, CODES AND STANDARDS.
- ALL CONDUIT UNDERGROUND SHALL BE SCHEDULE 80 PVC WITH RGS FITTINGS ABOVE GROUND. RGS FITTINGS SHALL EXTEND 2'-6" BELOW GROUND.
- ALL GENERAL NOTES, SYMBOL LISTS, AND ABBREVIATIONS SHALL BE CONSIDERED AS APPLICABLE TO ALL ELECTRICAL DRAWINGS FOR THIS PROJECT. SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET ARE FOR REFERENCE ONLY AND DO NOT INDICATE THEIR INCORPORATION IN THE DESIGN.

09/08/08 11:02am

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NO.	DATE	REVISIONS	BY	CHK
C	09/08/08	100% DESIGN EPA SUBMITTAL	REO	BDE
B	09/03/08	ISSUED FOR CLIENT REVIEW - 100% DESIGN	REO	BDE
A	08/05/08	ISSUED FOR CLIENT REVIEW - 45% DESIGN	REO	BDE

DRAWN: BDE	PROJECT NO: 6100-08-0016
ENGINEER: BDE	SCALE: NONE
CHECKED: REO	APPROVED: PHT
DATE: 08/05/08	DATE: 09/08/08

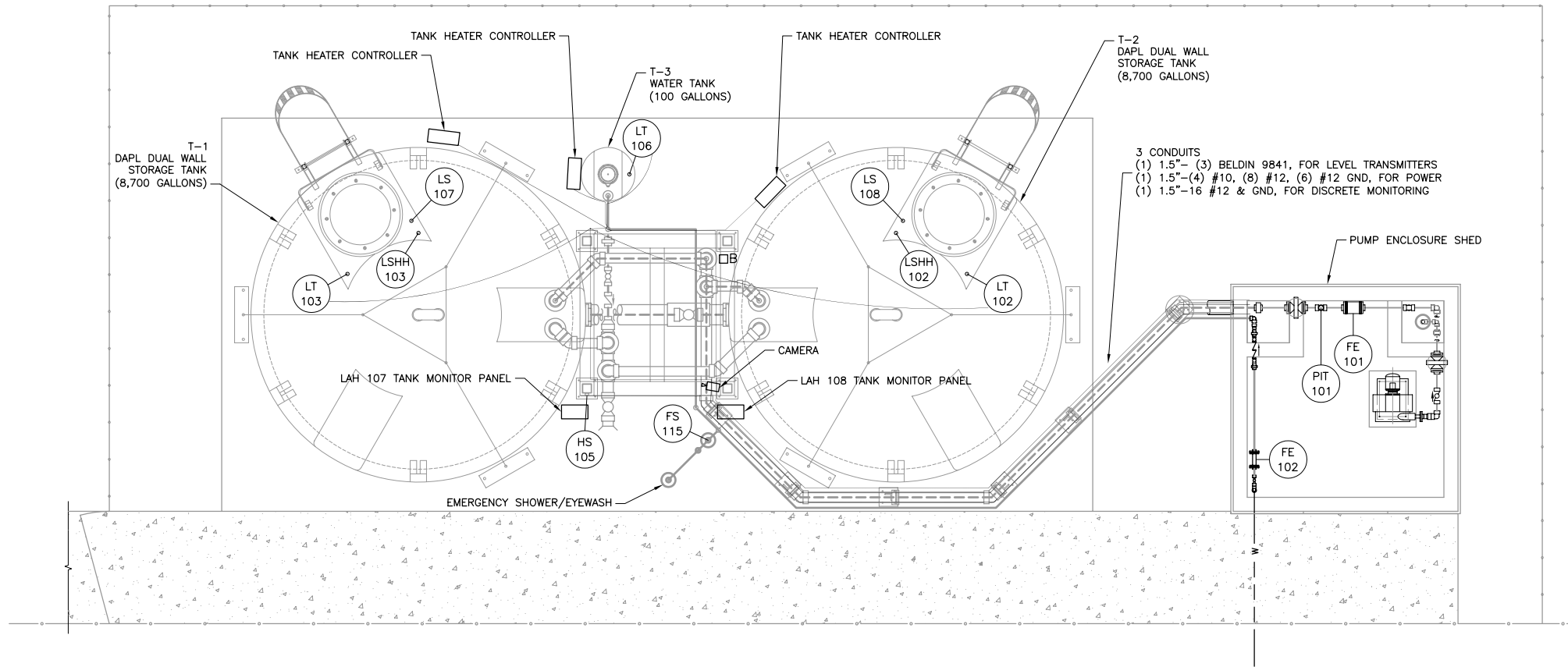
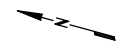


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DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

ELECTRICAL  
NOTES AND LEGEND

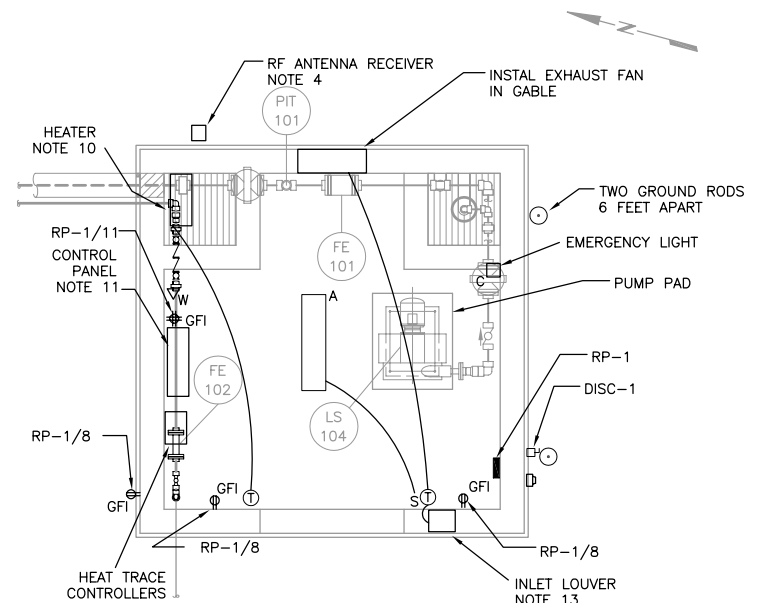
DRAWING NO: E-001
9
14



LOADING AREA ELECTRICAL PLAN  
NTS

NOTES:

1. SEE DRAWING E-001 FOR SYMBOLS AND LEGEND.
2. SEE DRAWING C-102 FOR ENTIRE SITE LAYOUT.
3. SEE DRAWING E-602 FOR ELECTRICAL SCHEDULES.
4. PROVIDE MAST FOR RF ANTENNA TO MATCH HEIGHT OF TRANSMITTER AT STORAGE TANKS. BOND MAST AND ANTENNA TO GROUND ROD.
5. SEAL CONDUIT PENETRATIONS THROUGH PUMP ENCLOSURE SHED WALL.
6. MOUNT RF TRANSMITTER ON PIPE SUPPORT STEEL STRUCTURE. MAXIMIZE HEIGHT AND CLEARPATH TO RECEIVER.
7. CAMERA AND RF TRANSMITTER POWER PANEL. PROVIDE TWO GFI DUPLEX OUTLETS INTERNALLY. PROVIDE TERMINALS FOR POWER CONNECTION TO TRANSMITTER AND CAMERA.
8. HEAT TRACE AND INSULATE 4" & 8" PVC CONTAINMENT PIPE, 4" PVC TANK EVACUATION PIPES AND ALL ABOVE GRADE WATER LINES EXTERNAL TO PUMP ENCLOSURE SHED. PROVIDE THREE CIRCUITS FOR ABOVE GROUND PIPING.
9. PROVIDE INDIVIDUAL CIRCUIT FOR EACH TANK HEATER CONTROL PANEL.
10. MOUNT HEATER A MINIMUM 78 INCHES ABOVE FINISHED FLOOR IN CORNER OF SHED. WIRE THERMOSTAT PER HEATER MANUFACTURES REQUIREMENTS.
11. CONTROL PANEL CONTAINS PLC FOR SYSTEM, PUMP ENCLOSURE SHED TEMPERATURE DISPLAY WITH HIGH AND LOW ALARM CONTACTS TO PLC.
12. MOUNT PUMP ENCLOSURE SHED CAMERA SO CONTROL PANEL IS VISIBLE AND FOCUS FOR CLARITY. MOUNT EXTERIOR CAMERAS ON PIPE SUPPORT STRUCTURE SO DAPL CONVEYANCE PIPING AND VALVES ARE VISIBLE AND FOCUS FOR CLARITY.
13. INSTALL INLET LOUVER NEAR FLOOR OF PUMP ENCLOSURE SHED. WIRE CONTROL TO THERMOSTAT FOR EXHAUST FAN. EXHAUST FAN TO BE MOUNTED IN GABLE OF PUMP ENCLOSURE SHED.
14. MOUNT HAND SWITCH HS105 ON PIPE SUPPORT STRUCTURE.
15. ROUTE CONDUITS FROM PUMP ENCLOSURE SHED TO TANK AREA FOLLOWING PIPING. ROUTE CONDUITS TO EACH DEVICE AS REQUIRED IN FIELD. COORDINATE INSTALLATION WITH PIPING AND SUPPORT REQUIREMENTS.
16. ALL ANALOG SIGNAL WIRE MUST BE ROUTED IN SEPARATE CONDUIT FROM POWER.



PUMP ENCLOSURE ELECTRICAL PLAN  
NTS

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**MACTEC**

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DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

ELECTRICAL  
PLAN VIEWS

DRAWING NO:  
E-101

10  
14

1.01 DESCRIPTION

A. THE DRAWINGS ARE BASICALLY DIAGRAMMATIC, UNLESS DETAILED DIMENSIONED DRAWINGS ARE INCLUDED, AND SHOW ONLY APPROXIMATE LOCATIONS OF EQUIPMENT, FIXTURES, PANELBOARDS, WIRING DEVICES, ETC.

B. WHILE THE GENERAL RUN OF ELECTRICAL FEEDERS, BRANCH CIRCUITS, CONDUITS, ETC. IS INDICATED ON THE DRAWINGS, IT IS NOT INTENDED THAT EXACT ROUTING BE DETERMINED THEREFROM. CIRCUIT DESIGNATIONS ON SINGLE LINE DIAGRAM, ELECTRICAL SCHEMATICS, INSTRUMENTATION SCHEMATICS, PANELBOARD SCHEDULES AND IN THE FORM OF "HOME RUNS" ON BRANCHES INDICATE THE DESIGNATION OF THE BRANCH CIRCUIT, THE SIZE AND QUANTITY OF BRANCH CIRCUIT CONDUCTORS, THE BRANCH CIRCUIT OVERCURRENT DEVICE RATING AND THE PANELBOARD OR INTERCONNECTION BOX FROM WHICH THE BRANCH CIRCUIT IS SERVED, THESE DESIGNATIONS MAY BE MODIFIED SUBJECT TO FIELD CONDITIONS.

C. ALL EQUIPMENT AND ACCESSORIES AND ITS INTERCONNECTING PIPING, DUCTWORK, CONDUIT, ETC., SHALL BE INSTALLED IN SUCH A MANNER THAT AMPLE MAINTENANCE AND PASSAGE SPACE AND CODE REQUIREMENT SPACE/ACCESS WILL BE PROVIDED.

D. WHERE MORE THAN ONE TRADE IS INVOLVED IN AN AREA, SPACE OR CHASE, ALL SHALL COOPERATE AND INSTALL THEIR OWN WORK TO UTILIZE THE SPACE EQUALLY BETWEEN THEM IN PROPORTION TO THEIR INDIVIDUAL REQUIREMENTS.

E. PROVIDE AND INSTALL ALL GROUNDING AND APPURTENANCES AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.

F. FURNISH AND INSTALL COMPLETE INSTRUMENTATION AND PROCESS CONTROL SYSTEMS AS DESCRIBED AND SPECIFIED HEREIN AND AS SHOWN ON THE CONTRACT DRAWINGS.

G. FURNISH AND INSTALL ALL TRANSUDCERS, CONVERTERS, TERMINALS, TRANSFORMERS, INTERPOSING OR PILOT RELAYS, SIGNAL TRANSMITTERS, SIGNAL SPLITTERS/BOOSTERS, LIGHTNING ARRESTORS, UNINTERRUPTIBLE POWER SUPPLIES, POWER SUPPLY CONNECTIONS AND OTHER MISCELLANEOUS INSTRUMENTATION REQUIRED TO MAKE A COMPLETE SYSTEM.

1.02 QUALITY ASSURANCE

A. IN GENERAL, THE WORKMANSHIP OF THE ELECTRICAL INSTALLATION SHALL BE AS DESCRIBED IN THE N.E.C.A. ELECTRICAL DESIGN GUIDELINES. ALL METHODS OF CONSTRUCTION, DETAILS OF WORKMANSHIP, ETC. THAT ARE NOT SPECIFICALLY DESCRIBED THEREIN OR INDICATED IN THE CONTRACT DOCUMENTS, SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. CONDUIT, RACEWAY AND TUBING

1. RIGID HEAVY WALL STEEL CONDUIT (RSC OR RGS) SHALL BE CONSTRUCTED OF HOT DIPPED GALVANIZED OR ELECTRO-GALVANIZED STEEL. ACCEPTABLE MANUFACTURERS: REPUBLIC, TRIANGLE PWC, ALLIED, WHEATLAND.

2. ALL FITTINGS SHALL BE OF THE SAME MATERIAL AS THE RESPECTIVE RACEWAY SYSTEM.

3. FITTINGS FOR SEALING AROUND CONDUITS PASSING THROUGH NEW BELOW-GRADE CONCRETE WALLS OR FLOOR SHALL BE O.Z./GEDNEY CO. TYPE FSK, OR EQUIVALENT.

4. CONDUIT WALL AND FLOOR SEALS FOR CORED HOLES AND SLEEVED OPENINGS SHALL BE TYPE CSM SERIES AS MANUFACTURED BY O.Z./GEDNEY CO., OR EQUIVALENT.

B. CONDUCTORS AND CABLE

1. ALL POWER WIRING CONDUCTORS SHALL BE INSULATED FOR 600 VOLTS, UNLESS OTHERWISE NOTED, AND SHALL BE STANDARD AWG AND MCM SIZES. CONDUCTORS SHALL BE 98 PERCENT LOCATED, STRANDED, HEAT AND MOISTURE RESISTANT AND THERMAL PLASTIC INSULATED FOR ALL SIZES NO. 12 AWG AND LARGER. SMALLER SIZES SHALL NOT BE USED EXCEPT FOR COMMUNICATIONS AND SPECIAL SYSTEMS. FOR LIGHTING AND RECEPTACLE CIRCUITS, SOLID WIRE MAY BE USED IN LIEU OF STRANDED WIRE, FOR NO. 12 AND NO. 10 AWG ONLY. CONDUCTORS SHALL BE LABELED WITH U.L. APPROVAL AND BE MARKED WITH THE MANUFACTURER'S NAME, WIRE SIZE AND INSULATION TYPE. INSULATION FOR ALL 600 VOLT CONDUCTORS SHALL BE TYPE THWN/THHN OR TYPE XHHW. ALL WIRING SHALL BE SUITABLE FOR WET WATER FILLED APPLICATIONS. ACCEPTABLE MANUFACTURERS: OKONITE, SOUTHWIRE, PIRELLI, CABLEC, BIW.

2. ALL CONTROL WIRING (120 OR 24 VOLT, AC OR DC) CONDUCTORS SHALL BE INSULATED FOR 600 VOLTS, UNLESS OTHERWISE NOTED, AND SHALL BE NO. 14 AWG MINIMUM SIZE, OR LARGER IF SO INDICATED ON THE DRAWINGS. CONDUCTORS SHALL BE 98 PERCENT COPPER, STRANDED, HEAT AND MOISTURE RESISTANT, AND THERMAL PLASTIC INSULATED. ACCEPTABLE MANUFACTURERS: OKONITE, SOUTHWIRE, PIRELLI.

3. TELEPHONE WIRING:

a. CONDUCTORS FOR TELEPHONE WIRING IN INDOOR APPLICATIONS SHALL BE 24 GAGE SOLID CONDUCTOR, TWO-PAIR, BELDEN CAT. NO. 9562, OR EQUIVALENT.

b. CONDUCTORS FOR UNDERGROUND TELEPHONE WIRING SHALL 24 GAGE SOLID CONDUCTOR, THREE-PAIR, BELDEN CAT. NO. 1244A1, OR EQUIVALENT.

C. OUTLET BOXES

1. OUTLET BOXES EXPOSED TO MOISTURE SHALL BE CADMIUM CAST ALLOY COMPLETE WITH HUBS AND GASKETED SCREW FASTENED COVERS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR THE CONDUCTOR SIZES INSTALLED.ACCEPTABLE MANUFACTURERS: STEEL CITY, APPLETON, CROUSE-HINDS, RACO.

D. PULL AND JUNCTION BOXES

1. BOXES SHALL BE CONSTRUCTED WITH TRIM FOR FLUSH OR SURFACE MOUNTING IN ACCORDANCE WITH THE LOCATION TO BE INSTALLED. PROVIDE SCREW-ON TYPE COVERS. BOXES INSTALLED IN DAMP LOCATIONS SHALL BE OF WATERTIGHT CONSTRUCTION WITH GASKETED COVER AND CONDUIT HUBS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR CONDUIT AND CONDUCTOR SIZES INSTALLED.

E. WIRING DEVICES

1. WIRING DEVICES SHALL BE SPECIFICATION GRADE AS DESCRIBED HEREIN. PROVIDE DEVICE COVER PLATES OF SATIN FINISH STAINLESS STEEL IN FINISHED AREAS. ACCEPTABLE MANUFACTURERS ARE: HUBBELL, GENERAL ELECTRIC, ARROW-HART, PASS AND SEYMOR, BRYANT, OR AS NOTED.

2. TOGGLE SWITCHES

a. 20 AMPERE, 1-POLE, 277 VOLT: HUBBELL 1221

b. 20 AMPERE, 3-WAY, 277 VOLT: HUBBELL 12233.

3. RECEPTACLES

a. 20 AMPERE, 125 VOLT, DUPLEX G.F.I. RECEPTACLE: HUBBELL GF-5362

b. 20 AMPERE, 125 VOLT, DUPLEX, WEATHERPROOF: CROUSE HINDS WLDR-1 WITH GFI RECEPTACLE.

4. TELEPHONE OUTLETS

a. PROVIDE 4" X 2" OUTLET BOX WITH HUBBELL PJ216 TELEPHONE PLATE. EACH BOX SHALL HAVE TWO OUTLETS WITH SEPARATE FEED LINES.

G. SAFETY SWITCHES

1. FURNISH AND INSTALL HEAVY DUTY SAFETY SWITCHES AS INDICATED ON THE PLANS AND SPECIFICATIONS. ALL SAFETY SWITCHES SHALL BE NEMA TYPE HD AND UNDERWRITERS LABORATORIES LISTED. ACCEPTABLE MANUFACTURERS: SQUARE-D, CUTLER HAMMER, GENERAL ELECTRIC, SIEMENS, OR EATON.

H. GROUNDING MATERIALS

1. PROVIDE EQUIPMENT GROUNDING AS SHOWN ON THE DRAWINGS

2. PROVIDE GROUNDING CONDUCTORS FROM GROUND ELECTRODES TO EQUIPMENT.

3. USE 3/4 INCH X 10 FOOT COPPERWELD GROUND RODS FOR DIRECT BURIAL.

4. DO NOT USE CONDUIT AS THE GROUND AND/OR BONDING CONDUCTOR.

5. BOND GROUND TERMINAL OF RECEPTACLES TO OUTLET BOXES WITH #12 AWG GREEN INSULATED WIRE.

6. FLEXIBLE METALLIC CONDUIT TO BE SUITABLE FOR GROUNDING SERVICE.

7. GROUND CONDUIT SYSTEM AND NEUTRAL CONDUCTOR OF WIRING SYSTEM WITH A CONNECTION AT THE MAIN ELECTRICAL SERVICE PANELBOARD.

8. GROUND RODS

a. GROUND RODS SHALL BE COPPER-CLAD STEEL AT LEAST 3/4-INCH IN DIAMETER AND 10 FEET LONG. DIE-STAMP EACH NEAR THE TOP WITH THE NAME OR TRADEMARK OF THE MANUFACTURER AND THE LENGTH OF THE ROD IN FEET. THE RODS SHALL HAVE A HARD, CLEAN, SMOOTH, CONTINUOUS, SURFACE THROUGHOUT THE LENGTH OF THE ROD.

I. HEAT TRACE

1. HEATING CABLE

a. SELF REGULATING, 230V, WITH A NOMINAL POWER OUTPUT OF 5 W/FT FOR EXPOSED PIPE.

b. TEMPERAUTE ID NUMBER OF T6:185 DEG F, CONSISTENT WITH NEC.

c. MINIMUM BEND RADIUS OF 0.5" AT 68 DEG F.

d. EQUAL TO RAYCHEM 5BTV.

2. END SEAL KIT

a. COMPATIBLE WITH BTV-CT HEAT CABLE.

b. ABOVE INSTALLATION END SEAL WITH RED SIGNAL LIGHT, COLD APPLIED.

c. INGRESS PROTECTION NEMA 4X

d. EQUAL TO RAYCHEM E-100-L2-A.

3. SINGLE ENTRY POWER KIT

a. FOR USE WITH CONDUIT.

b. COMPATIBLE WITH BTV-CT HEAT CABLE.

c. INGRESS PROTECTION NEMA 4X

d. MAXIMUM CONDUCTOR SIZE - 8 AWG.

e. EQUAL TO RAYCHEM JBS-100-A.

4. CONTROL SYSTEM

a. NEMA 4X PROTECTION.

b. RELATIVE HUMIDITY - 0% TO 90%, NONCONDENSING

c. RELAY TYPES - 2-POLE, SOLID STATE, NORMALLY OPEN

d. VOLTAGE, MAXIMUM - 277 VAC NOMINAL, 50/60 HZ

e. CURRENT, MAXIMUM - 30 A @ 104°F

f. CONTROL ALGORITHMS - LINE SENSING ON/OFF, PROPORTIONAL, PROPORTIONAL AMBIENT, POWER LIMITING, SOFT START

g. EQUAL TO DIGITRACE 920 SSR

J. LEVEL SWITCHES

1. MERCURY FREE, POLYPROPYLENE HOUSING FLOAT SWITCH, TETHERED MOUNTING. 10A 250VAC RATED SWITCH. EQUAL TO W.E. ANDERSON SERIES FSW.

2. NORTHEAST FLUID CONTROL MODEL 7010-A-4-20 WIDE ANGLE FLOAT, PUMP DOWN OR EQUAL.

K. LEVEL TRANSMITTERS

1. NORTHEAST FLUID CONTROL MODEL LU81-5101 ECHO SPAN 2-WIRE. 16.4 FOOT RANGE, DISPLAY, 2 INCH NPT, NEMA 4X.

H. FLOW METER

1. ULTRASONIC CLAMP ON FLOW METER FOR 0.5" PVC PIPE. FLOW RANGE 0.5 GPM TO 2 GPM. FLOW RATE AND TOTALIZER DISPLAY. TOTALIZER DISPLAY IN THOUSANDS OF GALLONS. 4-20 mA OUTPUT SIGNAL. SUITABLE FOR ENVIRONMENT. COORDINATE PIPE REQUIREMENTS WITH MECHANICAL. EQUAL TO DYNASONICS TFXL SERIES.

L. FLOW TOTALIZER

1. 5.5 DIGITS MINIMUM, 4-20MADC INPUT, DIGITAL READOUT, , 120V, NON VOLATILE MEMORY WITH NO LOSS OF TOTALIZED VALUE UPON LOSS OF SIGNAL AND OR POWER FAILURE. RESETABLE SETPOINT FOR BATCH CONTROL WITH DRY CONTACT OUTPUT AND PRE ALARM CONTACTS RATED 5A 120 VAC.

M. PC DVR CAMERA SYSTEM

1. INTEL PENTIUM 4 PROCESSOR, MICROSOFT XP OS, 512MB RAM, 160GB HARD DRIVE MINIMUM, 4 CHANNEL VIDEO CAPTURE CARD, DISPLAY/RECORD RATE 120 FPS NTSC. DVD-RW, 10/100 TCP/IP NETWORK CARD, 56K MODEM

2. CONFIGURE PC FOR REMOTE DESKTOP CONNECTION FOR OFF SITE VIEWING OF CAMERAS. COORDINATE PASSWORDS AND CONFIGURATION WITH OWNER.

3. MOTION DETECTION FUNCTION - MULTI ZONES & MULTI CHANNELS, PRE-ALARM/POST-ALARM RECORDING, ADJUSTABLE NUMBER OF RECORDING FRAME BY EACH CAMERA, RECORDING SCHEDULED BY DATE AND TIME.

4. IMAGE COMPENSATION FOR CLEAR IMAGE QUALITY, SUPPORT BACK UP DATA ON FDD, DVD-RW, ZIP DRIVE, DAT

5. ADJUSTABLE PLAYBACK SPEED FOR FAST SEARCH AND INTENSIVE SEARCH

6. 19" LCD MONITOR

7. EQUAL TO PRESTIGE 4120 SYSTEM.

N. CAMERA

1. 1/3" COLOR DAY/NIGHT SONY CCD, NTSC VIDEO FORMAT, RESOLUTION 480 LINES, BOARD LENS 6MM @ F2.0, IR RANGE UP TO 40' WITH 23 IR LEDS, ALL-WEATHER IP-66 ALUMINUM HOUSING, TEMPERATURE RANGE -30°F TO +170°F, 12 VDC POWER SUPPLY.

O. VIDEO TRANSMITTER/RECEIVER

1. 5.8 GHZ, 8 CHANNEL, 2000 FEET LINE OF SIGHT, 3 dB TRANSMITTER, 7 dB RECEIVER, IP67 HOUSING, 12 VDC POWER SUPPLY, MOUNTING HARDWARE AS REQUIRED, ANTENNA AND CAMERA CABLES AS REQUIRED, FCC/IC AND CE APPROVED. EQUAL TO VIDEOCOMM TCO-5808R6.

P. PRESSURE TRANSMITTER

1. SOLID STATE, PIEZO RESISTIVE SENSING, .25% ACCURACY, .5"NPT ANSI MOUNTING, .25 "FLUSHING CONNECTION, 0-100 PSIG, 4-20MADC OUTPUT, SPAN ADJUST, ZERO ADJUST, ADJUSTABLE DAMPENING, EXTERNAL POWER SOURCE, NEMA 4XSS 316SS/HASTELLOY WETTED PARTS, LOCAL DIGITAL READOUT, TAGGING, AND FACTORY CALIBRATION. PROVIDE PROCESS SEAL AS REQUIRED. HONEYWELL ST3000 OR EQUAL.

Q. AUTO DIALER

1. FOUR CHANNEL INPUT, 4 CUSTOM VOICE CALLOUTS, 1 CONTACT OUTPUT. EQUAL TO SENSAPHONE 400 MODEL.

R. PLC CONTROLLER

1. ALL INPUTS SHALL TERMINATE TO PLC. PLC SHALL DRIVE ALL OUTPUT NOTIFICATION DEVICES. .

2. MIN. MEMORY: 16 KILOBYTES OF PROGRAMMABLE RAM MEMORY AND 8K OF DATA STORAGE WITH EEPROM BACKUP.

3. MIN. NUMBER OF I/O POINTS (DISCRETE OR ANALOG): 960

4. POWER: 110/220 VAC POWER SUPPLY. THE PLC SHALL BE CONNECTED TO AN UNINTERRUPTIBLE POWER SUPPLY (UPS).

5. REQUIRED AGENCY APPROVALS: UL LISTED (UL 508), CSA CERTIFIED (CSA 142).

6. EXTERNAL COMMUNICATIONS VIA RS-232/485/ETHERNET PORTS.

7. PROGRAMMING AND DIAGNOSTIC SOFTWARE SHALL BE IBM-COMPATIBLE (MS DOS OR WINDOWS BASED) VIA RELAY LADDER LOGIC (RLL), BASIC, AND CUSTOM PROGRAMMING TOOLS FOR THE PLCs. PROVIDE A LICENSED COPY, IN THE NAME OF THE OWNER, OF ALL PROGRAMMING SOFTWARE USED TO CONFIGURE THE PLCs. THE SOFTWARE SHALL INCLUDE BOTH THE SOFTWARE AND HARDWARE (I.E. CABLES, INTERFACE BOX, ETC.) REQUIRED FOR DIRECT PLC-TO-PC COMMUNICATIONS FOR PLC PROGRAMMING. ALL SOFTWARE SHALL BE PROVIDED ON 3.5" HD DISKETTES OR CD ROM. A COPY OF EACH PLC PROGRAM SHALL BE PROVIDED TO ALLOW FOR DOWNLOADING INTO A PLC. ALL PLCs SHALL BE PROGRAMMABLE AND OPERATE ON THE SAME SOFT AND SOFT WARE LICENSE.

8. PROVIDE PROGRAMMING TIME REQUIRED TO CONFIGURE PLC TO PROVIDE COMPLETE CONTROL AND MONITORING FUNCTIONS AS DESCRIBED IN DRAWINGS AND DESCRIBED BELOW.

9. THE EXTRACTION PUMP SHALL OPERATE UNTIL LAH102,LAHH102, LAH103, OR LAHH103 IS ACTIVATED OR TANKER FILL FLOW TOTALIZER (RESETABLE, ADJUSTABLE) REACHES SETPOINT. THE FOLLOWING DEVICES SHALL STOP THE EXTRACTION PUMP IMMEDIATELY AND INITIATE THE AUTODIALER CALLOUT FOR ALARM CONDITION: LAH101, LAHH102, LAHH103, LAH106, LAH109 PAH101(ADJUSTABLE), HS105 (E-STOP), ONCE THE PUMP IS STOPPED BY AN ALARM CONDITION IT WILL ONLY RESTART MANUALLY AT THE CONTROL PANEL WHEN ALARMS ARE CLEAR. WHEN YAH110, YAH111 OR YAH 112 IS ACTIVATED THE PLC SHALL INITIATE THE AUTODIALER AS A PRE-ALARM CONDITION.

10. ALLEN-BRADLEY MICROLOGIX 1100 OR EQUAL.

11. PROVIDE ALLEN-BRADLEY PANELVIEW 500 OR EQUAL FOR TANK LEVEL READOUTS IN PERCENT FULL AND GALLONS,FLOW TOTALS, SETPOINTS AND SETPOINT ADJUSTMENT.

S. CONTROL PANEL HARDWARE

1. ALL ALARM INDICATING DEVICES SHALL BE PILOT LIGHT LED TYPE, SHALL BE THROUGH-DOOR TYPE SEALED WITH EQUIPMENT MANUFACTURERS RECOMMENDATIONS.

2. ALL H-O-A SWITCHES AND PUSH BUTTON SWITCHES, SHALL BE THROUGH-DOOR FLUSH MOUNTED AND SEALED IN ACCORDANCE WITH RESPECTIVE EQUIPMENT AND CONTROL PANEL MANUFACTURERS RECOMMENDATIONS

PART 3 - EXECUTION

3.01 INSTALLATION

A. UNLESS OTHERWISE NOTED, WIRING FOR ALL SYSTEMS INDICATED IN THE CONTRACT DOCUMENTS SHALL CONSIST OF INSULATED CONDUCTORS INSTALLED IN RACEWAYS. RACEWAYS SHALL BE CONTINUOUS FROM OUTLET BOX TO OUTLET BOX AND FROM OUTLET BOX TO CABINET, JUNCTION OR PULL BOX. SECURE AND BOND RACEWAYS TO ALL BOXES AND CABINETS SUCH THAT EACH SYSTEM OF RACEWAYS WILL BE ELECTRICALLY CONTINUOUS THROUGHOUT.

B. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, INSTALL ALL WIRING IN THE FOLLOWING APPLICABLE RACEWAY SYSTEM:

1. WIRING 600 VOLTS OR LESS IN DRY CONCEALED LOCATIONS: GALVANIZED RIGID HEAVY WALL STEEL CONDUIT.

2. WIRING 600 VOLTS OR LESS IN DRY EXPOSED INDOOR LOCATIONS GALVANIZED RIGID HEAVY WALL STEEL CONDUIT.

3. WIRING 600 VOLTS OR LESS IN OUTDOOR, ABOVE GRADE LOCATIONS: GALVANIZED RIGID HEAVY WALL STEEL CONDUIT.

4. WIRING 600 VOLTS OR LESS IN INDOOR WET LOCATIONS: GALVANIZED RIGID HEAVY WALL STEEL CONDUIT.

5. FLEXIBLE METAL CONDUIT SHALL BE USED FOR FINAL CONNECTION TO ALL MOTORS, FINAL CONNECTION TO ROTATING OR VIBRATING EQUIPMENT, FINAL CONNECTIONS TO DRY TYPE TRANSFORMERS AND FINAL CONNECTIONS TO RECESSED LIGHTING FIXTURES. LIQUID-TIGHT FLEXIBLE CONDUIT SHALL BE USED IN ALL WET OR DAMP LOCATIONS. MAXIMUM LENGTH OF FLEXIBLE CONDUIT SHALL BE 36 INCHES, EXCEPT THAT FROM OUTLET BOXES TO LIGHTING FIXTURE MAXIMUM LENGTH SHALL BE 6 FEET.

C. RACEWAYS SHALL BE:

1. SIZED AS INDICATED ON THE DRAWINGS. WHERE SIZES ARE NOT INDICATED, RACEWAYS SHALL BE SIZED PER THE NATIONAL ELECTRICAL CODE IN ACCORDANCE WITH THE QUANTITY, SIZE, TYPE AND INSULATION OF CONDUCTORS TO BE INSTALLED; HOWEVER, RACEWAYS SHALL BE MINIMUM THREE-QUARTER (3/4") TRADE SIZE.

2. INSTALLED TO PROVIDE ADEQUATE GROUNDING BETWEEN ALL OUTLETS AND THE ESTABLISHED ELECTRICAL SYSTEM GROUND.

3. CUT SQUARE, FREE OF BURRS DUE TO FIELD CUTTING OR MANUFACTURE, AND BUSHED WHERE NECESSARY.

4. INSTALLED WITH EXTERIOR SURFACES NOT LESS THAN SIX INCHES (6") FROM ANY SURFACE WITH A TEMPERATURE OF 200 DEGREES F OR HIGHER.

5. PLUGGED AT THE ENDS OF EACH ROUGHED-IN RACEWAY WITH AN APPROVED CAP OR DISC TO PREVENT THE ENTRANCE OF FOREIGN MATERIALS DURING CONSTRUCTION.

6. INSTALLED PARALLEL OR PERPENDICULAR TO FLOORS, WALLS AND CEILINGS.

7. ARRANGED IN A NEAT MANNER FOR ACCESS AND ALLOW FOR ACCESS TO WORK INSTALLED BY OTHER TRADES.

8. PROVIDE A BUSHING AT EACH CONDUIT TERMINATION UNLESS FITTING AT BOX WHERE CONDUIT TERMINATES HAS HUBS DESIGNED IN SUCH A MANNER TO AFFORD EQUIVALENT PROTECTION TO CONDUCTORS. PROVIDE GROUNDING TYPE INSULATED BUSHINGS ON ALL CONDUIT SIZES ONE AND ONE-QUARTER INCH (1-1/4") TRADE SIZE AND LARGER, AND ON ALL FEEDER RACEWAYS REGARDLESS OF SIZE. PROVIDE STANDARD BUSHINGS FOR CONDUITS ONE INCH (1") AND SMALLER UNLESS OTHERWISE STATED. PROVIDE SEALING BUSHINGS FOR ALL CONDUITS ENTERING FROM BELOW GRADE.

D. BECOME FAMILIAR WITH THE GENERAL CONSTRUCTION OF THE SITE AND PLACE SLEEVES, INSERTS, ETC., AS REQUIRED. ALL PENETRATIONS THROUGH NEW BELOW-GRADE CONCRETE WALLS OR FLOORS SHALL BE SEALED USING FITTINGS AS SPECIFIED IN ABOVE.

E. WIRING METHODS

1. DO NOT PULL CONDUCTORS INTO RACEWAYS UNTIL RACEWAY SYSTEM, INCLUDING ALL OUTLETS, CABINETS, BUSHINGS AND FITTINGS, IS COMPLETED. VERIFY THAT ALL WORK OF OTHER TRADES WHICH MAY CAUSE CONDUCTOR DAMAGE IS COMPLETED. USE ONLY U.L. APPROVED CABLE LUBRICANTS WHEN NECESSARY. DO NOT USE MECHANICAL MEANS TO PULL CONDUCTORS NO. 8 OR SMALLER.

2. IN GENERAL, CONDUCTORS SHALL BE THE SAME SIZE FROM THE LAST PROTECTIVE DEVICE TO THE LOAD.

3. ALL WIRING SYSTEMS SHALL BE PROPERLY GROUNDDED AND CONTINUOUSLY POLARIZED THROUGHOUT, FOLLOWING STANDARD COLOR CODING.

4. FOR SPLICES AND TAPS, NO. LO AWG AND SMALLER, USE SOLDERLESS "THREAD-ON" CONNECTORS HAVING SPIRAL STEEL SPRING AND INSULATED WITH A VINYL CAP AND SKIRT, AS MANUFACTURED BY 3M CO. (PRE- INSULATED "SCOTCH-LOCK") OR IDEAL ("WING-NUTS").

5. FOR SPLICES AND TAPS, NO. 8 AND LARGER, USE SOLDERLESS "SPLIT BOLT" TYPE CONNECTOR AS MANUFACTURED BY ANDERSON, BURNDY, KEARNEY, THOMAS & BETTS, OR APPROVED EQUAL.

6. USE CAST CONNECTIONS, CADWELD OR THERMOWELD, FOR GROUND CONDUCTORS.

7. MAKE ALL SPLICES AND CONNECTIONS IN ACCESSIBLE BOXES AND CABINETS ONLY.

8. COVER UNINSULATED SPLICES, JOINTS AND FREE ENDS OF CONDUCTOR WITH RUBBER AND FRICTION TAPE OR PVC ELECTRICAL TAPE. PLASTIC INSULATING CAPS MAY SERVE AS INSULATION.

9. ON TERMINATION AT BRANCH CIRCUIT OUTLETS, LEAVE A MINIMUM OF EIGHT INCHES (8") FREE CONDUCTOR FOR INSTALLATION OF DEVICES AND FIXTURES.

10. FEEDER CONDUCTORS SHALL BE CONTINUOUS FROM POINT OF ORIGIN TO LOAD TERMINATION WITHOUT SPLICE. IF THIS IS NOT PRACTICAL, CONTACT THE ENGINEER AND RECEIVE WRITTEN APPROVAL FOR SPLICING PRIOR TO INSTALLATION OF FEEDER(S). WHERE FEEDER CONDUCTORS PASS THROUGH JUNCTION AND PULL BOXES, BIND AND LACE CONDUCTORS OF EACH FEEDER TOGETHER. FOR PARALLEL SETS OF CONDUCTORS, MATCH LENGTHS OF CONDUCTORS AS NEAR EQUAL AS POSSIBLE.

11. LIGHTING FIXTURES SHALL BE INSTALLED WITH EXPOSED WIRING AFTER EQUIPMENT, PIPING, ETC., ARE IN PLACE. IN GENERAL, LIGHTING SHALL BE AS LOCATED ON THE DRAWINGS, HOWEVER, WHERE CONFLICTS EXIST, LOCATE LIGHTS FOR BEST DISTRIBUTION.

12. INSTALL HEAT TRACE CABLES AND CONNECTIONS PER MANUFACTURERS REQUIREMENTS.

F. OUTLET BOXES

1. CONSIDER LOCATION OF OUTLETS SHOWN ON DRAWINGS AS APPROXIMATE ONLY. LOCATE OUTLET SO THAT WHEN FIXTURES, MOTORS, CABINETS, EQUIPMENT, ETC., ARE PLACED IN POSITION, OUTLET WILL SERVE ITS DESIRED PURPOSE.

2. WHERE SWITCH OUTLETS ARE SHOWN ADJACENT TO STRIKE SIDE OF DOOR, LOCATE EDGE OF OUTLET BOX APPROXIMATELY 3 INCHES FROM DOOR FRAME.

3. OUTLET BOXES SHALL BE SIZED TO ACCOMMODATE THE WIRING DEVICE(S) TO BE INSTALLED.

4. SURFACE CEILING MOUNTED OUTLET BOXES SHALL BE MINIMUM 4 INCHES SQUARE, 1-1/2 INCHES DEEP, GALVANIZED SHEET METAL.

5. SURFACE WALL MOUNTED OUTLET BOXES SHALL BE CAST TYPE BOXES HAVING THREADED OR COMPRESSION TYPE THREADED HUBS. EXTERIOR BOXES SHALL BE CAST TYPE WITH THREADED HUBS AND GASKETED COVER PLATES SECURED BY NON-FERROUS SCREWS.

6. INSTALL A DEVICE COVER PLATE OVER EACH AND EVERY OUTLET INDICATED ON DRAWINGS. DO NOT INSTALL PLATES UNTIL PAINTING, CLEANING AND FINISHING OF SURFACES SURROUNDING THE OUTLET ARE COMPLETE. INSTALL SINGLE ONE-PIECE MULTI-GANG COVERS OVER MULTI-GANG DEVICES.

G. JUNCTION AND PULL BOXES

1. INSTALL JUNCTION AND PULL BOXES IN READILY ACCESSIBLE LOCATIONS. ACCESS TO BOXES SHALL NOT BE BLOCKED BY EQUIPMENT, PIPING, DUCTS AND THE LIKE. PROVIDE ALL NECESSARY JUNCTION OR PULL BOXES REQUIRED DUE TO FIELD CONDITIONS AND AS REQUIRED BY THE NATIONAL ELECTRICAL CODE.

H. EQUIPMENT MOUNTING HEIGHTS

1. UNLESS OTHERWISE NOTED, MOUNT DEVICES AND EQUIPMENT AT HEIGHTS MEASURED FROM FINISHED FLOOR TO DEVICE/EQUIPMENT BASE AS FOLLOWS: (DEVICE BASE TO BE SET AT CMU JOINT UNLESS OTHERWISE NOTED.)

a. TOGGLE SWITCHES (UP POSITION "ON"): 48"

b. RECEPTACLE OUTLETS (LONG DIMENSION VERTICAL, GROUND POLE NEAREST FLOOR): 24"

c. TELEPHONE OUTLETS, WALL MOUNTED: 48"

d. BRANCH CIRCUIT PANELBOARDS, TO TOP OF BACKBOX: 72"

e. DISCONNECT SWITCHES, MOTOR STARTERS, ENCLOSED CIRCUIT BREAKERS, TO TOP OF BOX: 60".

2. WHERE STRUCTURAL OR OTHER INTERFERENCE'S PREVENT COMPLIANCE WITH MOUNTING HEIGHTS LISTED ABOVE, CONSULT ENGINEER FOR APPROVAL TO CHANGE LOCATION BEFORE INSTALLATION. ALL MOUNTING HEIGHTS SHALL COMPLY WITH LATEST APPLICABLE CODES.

I. HANGERS AND SUPPORTS

1. PROVIDE STEEL ANGLES, CHANNELS AND OTHER MATERIALS NECESSARY FOR THE PROPER SUPPORT AND ERECTION OF EQUIPMENT.

J. GROUNDING INSTALLATION

1. MAKE CONNECTIONS TO GROUND RODS WITH AN EXOTHERMIC WELDING PROCESS. MECHANICAL CONNECTIONS MAY BE MADE AT EQUIPMENT ONLY.

2. ENSURE THAT A GROUND LOOP IS NOT FORMED BETWEEN EQUIPMENT GROUND IN ELECTRICAL CONDUIT AND GROUNDING ELECTRODE CONDUCTORS DIRECTLY CONNECTED TO GROUND ELECTRODES.

3. EQUIP EXPOSED "PIGTAILS" OR GROUNDING ELECTRODE CONDUCTORS WITH AN ARMORED SHEATH.

4. GROUP AND BOND GROUND WIRES TO PANEL BOXES, LIGHT FIXTURES, RECEPTACLES, ETC., NOT TO SYSTEM NEUTRAL.

5. MAKE CONNECTION TO ROOF COVER OVER RAIL CAR WITH A SUITABLE GROUND CLAMP OR LUG CONNECTION.

3.02 TESTS

A. BRANCH CIRCUITS SHALL BE TESTED DURING INSTALLATION FOR CONTINUITY AND IDENTIFICATION AND SHALL PASS OPERATIONAL TESTS TO DETERMINE THAT ALL CIRCUITS PERFORM THE FUNCTION FOR WHICH THEY ARE DESIGNED.

1.01 DESCRIPTION

A. THE DRAWINGS ARE BASICALLY DIAGRAMMATIC, UNLESS DETAILED DIMENSIONED DRAWINGS ARE INCLUDED, AND SHOW ONLY APPROXIMATE LOCATIONS OF EQUIPMENT, FIXTURES, PANELBOARDS, WIRING DEVICES, ETC.

B. WHILE THE GENERAL RUN OF ELECTRICAL FEEDERS, BRANCH CIRCUITS, CONDUITS, ETC. IS INDICATED ON THE DRAWINGS, IT IS NOT INTENDED THAT EXACT ROUTING BE DETERMINED THEREFROM. CIRCUIT DESIGNATIONS ON SINGLE LINE DIAGRAMS, ELECTRICAL SCHEMATICS, INSTRUMENTATION SCHEMATICS, PANELBOARD SCHEDULES AND IN THE FORM OF "HOME RUNS" ON BRANCHES INDICATE THE DESIGNATION OF THE BRANCH CIRCUIT, THE SIZE AND QUANTITY OF BRANCH CIRCUIT CONDUCTORS, THE BRANCH CIRCUIT OVERCURRENT DEVICE RATING AND THE PANELBOARD OR INTERCONNECTION BOX FROM WHICH THE BRANCH CIRCUIT IS SERVED, THESE DESIGNATIONS MAY BE MODIFIED SUBJECT TO FIELD CONDITIONS.

C. ALL EQUIPMENT AND ACCESSORIES AND ITS INTERCONNECTING PIPING, DUCTWORK, CONDUIT, ETC., SHALL BE INSTALLED IN SUCH A MANNER THAT AMPLE MAINTENANCE AND PASSAGE SPACE AND CODE REQUIREMENT SPACE/ACCESS WILL BE PROVIDED.

D. WHERE MORE THAN ONE TRADE IS INVOLVED IN AN AREA, SPACE OR CHASE, ALL SHALL COOPERATE AND INSTALL THEIR OWN WORK TO UTILIZE THE SPACE EQUALLY BETWEEN THEM IN PROPORTION TO THEIR INDIVIDUAL REQUIREMENTS.

E. PROVIDE AND INSTALL ALL GROUNDING AND APPURTENANCES AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.

F. FURNISH AND INSTALL COMPLETE INSTRUMENTATION AND PROCESS CONTROL SYSTEMS AS DESCRIBED AND SPECIFIED HEREIN AND AS SHOWN ON THE CONTRACT DRAWINGS.

G. FURNISH AND INSTALL ALL TRANSUDCERS, CONVERTERS, TERMINALS, TRANSFORMERS, INTERPOSING OR PILOT RELAYS, SIGNAL TRANSMITTERS, SIGNAL SPLITTERS/BOOSTERS, LIGHTNING ARRESTORS, UNINTERRUPTIBLE POWER SUPPLIES, POWER SUPPLY CONNECTIONS AND OTHER MISCELLANEOUS INSTRUMENTATION REQUIRED TO MAKE A COMPLETE SYSTEM.

1.02 QUALITY ASSURANCE

A. IN GENERAL, THE WORKMANSHIP OF THE ELECTRICAL INSTALLATION SHALL BE AS DESCRIBED IN THE N.E.C.A. ELECTRICAL DESIGN GUIDELINES. ALL METHODS OF CONSTRUCTION, DETAILS OF WORKMANSHIP, ETC. THAT ARE NOT SPECIFICALLY DESCRIBED THEREIN OR INDICATED IN THE CONTRACT DOCUMENTS, SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. CONDUIT, RACEWAY AND TUBING

1. RIGID HEAVY WALL STEEL CONDUIT (RSC OR RGS) SHALL BE CONSTRUCTED OF HOT DIPPED GALVANIZED OR ELECTRO-GALVANIZED STEEL. ACCEPTABLE MANUFACTURERS: REPUBLIC, TRIANGLE PWC, ALLIED, WHEATLAND.

2. ALL FITTINGS SHALL BE OF THE SAME MATERIAL AS THE RESPECTIVE RACEWAY SYSTEM.

3. FITTINGS FOR SEALING AROUND CONDUITS PASSING THROUGH NEW BELOW-GRADE CONCRETE WALLS OR FLOOR SHALL BE O.Z./GEDNEY CO. TYPE FSK, OR EQUIVALENT.

4. CONDUIT WALL AND FLOOR SEALS FOR CORED HOLES AND SLEEVED OPENINGS SHALL BE TYPE CSM SERIES AS MANUFACTURED BY O.Z./GEDNEY CO., OR EQUIVALENT.

B. CONDUCTORS AND CABLE

1. ALL POWER WIRING CONDUCTORS SHALL BE INSULATED FOR 600 VOLTS, UNLESS OTHERWISE NOTED, AND SHALL BE STANDARD AWG AND MCM SIZES. CONDUCTORS SHALL BE 98 PERCENT LOCATED, STRANDED, HEAT AND MOISTURE RESISTANT AND THERMAL PLASTIC INSULATED FOR ALL SIZES NO. 12 AWG AND LARGER. SMALLER SIZES SHALL NOT BE USED EXCEPT FOR COMMUNICATIONS AND SPECIAL SYSTEMS. FOR LIGHTING AND RECEPTACLE CIRCUITS, SOLID WIRE MAY BE USED IN LIEU OF STRANDED WIRE, FOR NO. 12 AND NO. 10 AWG ONLY. CONDUCTORS SHALL BE LABELED WITH U.L. APPROVAL AND BE MARKED WITH THE MANUFACTURER'S NAME, WIRE SIZE AND INSULATION TYPE. INSULATION FOR ALL 600 VOLT CONDUCTORS SHALL BE TYPE THWN/THHN OR TYPE XHHW. ALL WIRING SHALL BE SUITABLE FOR WET WATER FILLED APPLICATIONS. ACCEPTABLE MANUFACTURERS: OKONITE, SOUTHWIRE, PIRELLI, CABLEC, BIW.

2. ALL CONTROL WIRING (120 OR 24 VOLT, AC OR DC) CONDUCTORS SHALL BE INSULATED FOR 600 VOLTS, UNLESS OTHERWISE NOTED, AND SHALL BE NO. 14 AWG MINIMUM SIZE, OR LARGER IF SO INDICATED ON THE DRAWINGS. CONDUCTORS SHALL BE 98 PERCENT COPPER, STRANDED, HEAT AND MOISTURE RESISTANT, AND THERMAL PLASTIC INSULATED. ACCEPTABLE MANUFACTURERS: OKONITE, SOUTHWIRE, PIRELLI.

3. TELEPHONE WIRING:

a. CONDUCTORS FOR TELEPHONE WIRING IN INDOOR APPLICATIONS SHALL BE 24 GAGE SOLID CONDUCTOR, TWO-PAIR, BELDEN CAT. NO. 9562, OR EQUIVALENT.

b. CONDUCTORS FOR UNDERGROUND TELEPHONE WIRING SHALL 24 GAGE SOLID CONDUCTOR, THREE-PAIR, BELDEN CAT. NO. 1244A1, OR EQUIVALENT.

C. OUTLET BOXES

1. OUTLET BOXES EXPOSED TO MOISTURE SHALL BE CADMIUM CAST ALLOY COMPLETE WITH HUBS AND GASKETED SCREW FASTENED COVERS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR THE CONDUCTOR SIZES INSTALLED.ACCEPTABLE MANUFACTURERS: STEEL CITY, APPLETON, CROUSE-HINDS, RACO.

D. PULL AND JUNCTION BOXES

1. BOXES SHALL BE CONSTRUCTED WITH TRIM FOR FLUSH OR SURFACE MOUNTING IN ACCORDANCE WITH THE LOCATION TO BE INSTALLED. PROVIDE SCREW-ON TYPE COVERS. BOXES INSTALLED IN DAMP LOCATIONS SHALL BE OF WATERTIGHT CONSTRUCTION WITH GASKETED COVER AND CONDUIT HUBS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR CONDUIT AND CONDUCTOR SIZES INSTALLED.

E. WIRING DEVICES

1. WIRING DEVICES SHALL BE SPECIFICATION GRADE AS DESCRIBED HEREIN. PROVIDE DEVICE COVER PLATES OF SATIN FINISH STAINLESS STEEL IN FINISHED AREAS. ACCEPTABLE MANUFACTURERS ARE: HUBBELL, GENERAL ELECTRIC, ARROW-HART, PASS AND SEYMOR, BRYANT, OR AS NOTED.

2. TOGGLE SWITCHES

a. 20 AMPERE, 1-POLE, 277 VOLT: HUBBELL 1221

b. 20 AMPERE, 3-WAY, 277 VOLT: HUBBELL 12233.

3. RECEPTACLES

a. 20 AMPERE, 125 VOLT, DUPLEX G.F.I. RECEPTACLE: HUBBELL GF-5362

b. 20 AMPERE, 125 VOLT, DUPLEX, WEATHERPROOF: CROUSE HINDS WLDR-1 WITH GFI RECEPTACLE.

4. TELEPHONE OUTLETS

1.01 DESCRIPTION

A. THE DRAWINGS ARE BASICALLY DIAGRAMMATIC, UNLESS DETAILED DIMENSIONED DRAWINGS ARE INCLUDED, AND SHOW ONLY APPROXIMATE LOCATIONS OF EQUIPMENT, FIXTURES, PANELBOARDS, WIRING DEVICES, ETC.

B. WHILE THE GENERAL RUN OF ELECTRICAL FEEDERS, BRANCH CIRCUITS, CONDUITS, ETC. IS INDICATED ON THE DRAWINGS, IT IS NOT INTENDED THAT EXACT ROUTING BE DETERMINED THEREFROM. CIRCUIT DESIGNATIONS ON SINGLE LINE DIAGRAMS, ELECTRICAL SCHEMATICS, INSTRUMENTATION SCHEMATICS, PANELBOARD SCHEDULES AND IN THE FORM OF "HOME RUNS" ON BRANCHES INDICATE THE DESIGNATION OF THE BRANCH CIRCUIT, THE SIZE AND QUANTITY OF BRANCH CIRCUIT CONDUCTORS, THE BRANCH CIRCUIT OVERCURRENT DEVICE RATING AND THE PANELBOARD OR INTERCONNECTION BOX FROM WHICH THE BRANCH CIRCUIT IS SERVED, THESE DESIGNATIONS MAY BE MODIFIED SUBJECT TO FIELD CONDITIONS.

C. ALL EQUIPMENT AND ACCESSORIES AND ITS INTERCONNECTING PIPING, DUCTWORK, CONDUIT, ETC., SHALL BE INSTALLED IN SUCH A MANNER THAT AMPLE MAINTENANCE AND PASSAGE SPACE AND CODE REQUIREMENT SPACE/ACCESS WILL BE PROVIDED.

D. WHERE MORE THAN ONE TRADE IS INVOLVED IN AN AREA, SPACE OR CHASE, ALL SHALL COOPERATE AND INSTALL THEIR OWN WORK TO UTILIZE THE SPACE EQUALLY BETWEEN THEM IN PROPORTION TO THEIR INDIVIDUAL REQUIREMENTS.

E. PROVIDE AND INSTALL ALL GROUNDING AND APPURTENANCES AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.

F. FURNISH AND INSTALL COMPLETE INSTRUMENTATION AND PROCESS CONTROL SYSTEMS AS DESCRIBED AND SPECIFIED HEREIN AND AS SHOWN ON THE CONTRACT DRAWINGS.

G. FURNISH AND INSTALL ALL TRANSUDCERS, CONVERTERS, TERMINALS, TRANSFORMERS, INTERPOSING OR PILOT RELAYS, SIGNAL TRANSMITTERS, SIGNAL SPLITTERS/BOOSTERS, LIGHTNING ARRESTORS, UNINTERRUPTIBLE POWER SUPPLIES, POWER SUPPLY CONNECTIONS AND OTHER MISCELLANEOUS INSTRUMENTATION REQUIRED TO MAKE A COMPLETE SYSTEM.

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A. IN GENERAL, THE WORKMANSHIP OF THE ELECTRICAL INSTALLATION SHALL BE AS DESCRIBED IN THE N.E.C.A. ELECTRICAL DESIGN GUIDELINES. ALL METHODS OF CONSTRUCTION, DETAILS OF WORKMANSHIP, ETC. THAT ARE NOT SPECIFICALLY DESCRIBED THEREIN OR INDICATED IN THE CONTRACT DOCUMENTS, SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. CONDUIT, RACEWAY AND TUBING

1. RIGID HEAVY WALL STEEL CONDUIT (RSC OR RGS) SHALL BE CONSTRUCTED OF HOT DIPPED GALVANIZED OR ELECTRO-GALVANIZED STEEL. ACCEPTABLE MANUFACTURERS: REPUBLIC, TRIANGLE PWC, ALLIED, WHEATLAND.

2. ALL FITTINGS SHALL BE OF THE SAME MATERIAL AS THE RESPECTIVE RACEWAY SYSTEM.

3. FITTINGS FOR SEALING AROUND CONDUITS PASSING THROUGH NEW BELOW-GRADE CONCRETE WALLS OR FLOOR SHALL BE O.Z./GEDNEY CO. TYPE FSK, OR EQUIVALENT.

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B. CONDUCTORS AND CABLE

1. ALL POWER WIRING CONDUCTORS SHALL BE INSULATED FOR 600 VOLTS, UNLESS OTHERWISE NOTED, AND SHALL BE STANDARD AWG AND MCM SIZES. CONDUCTORS SHALL BE 98 PERCENT LOCATED, STRANDED, HEAT AND MOISTURE RESISTANT AND THERMAL PLASTIC INSULATED FOR ALL SIZES NO. 12 AWG AND LARGER. SMALLER SIZES SHALL NOT BE USED EXCEPT FOR COMMUNICATIONS AND SPECIAL SYSTEMS. FOR LIGHTING AND RECEPTACLE CIRCUITS, SOLID WIRE MAY BE USED IN LIEU OF STRANDED WIRE, FOR NO. 12 AND NO. 10 AWG ONLY. CONDUCTORS SHALL BE LABELED WITH U.L. APPROVAL AND BE MARKED WITH THE MANUFACTURER'S NAME, WIRE SIZE AND INSULATION TYPE. INSULATION FOR ALL 600 VOLT CONDUCTORS SHALL BE TYPE THWN/THHN OR TYPE XHHW. ALL WIRING SHALL BE SUITABLE FOR WET WATER FILLED APPLICATIONS. ACCEPTABLE MANUFACTURERS: OKONITE, SOUTHWIRE, PIRELLI, CABLEC, BIW.

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b. CONDUCTORS FOR UNDERGROUND TELEPHONE WIRING SHALL 24 GAGE SOLID CONDUCTOR, THREE-PAIR, BELDEN CAT. NO. 1244A1, OR EQUIVALENT.

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1. OUTLET BOXES EXPOSED TO MOISTURE SHALL BE CADMIUM CAST ALLOY COMPLETE WITH HUBS AND GASKETED SCREW FASTENED COVERS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR THE CONDUCTOR SIZES INSTALLED.ACCEPTABLE MANUFACTURERS: STEEL CITY, APPLETON, CROUSE-HINDS, RACO.

D. PULL AND JUNCTION BOXES

1. BOXES SHALL BE CONSTRUCTED WITH TRIM FOR FLUSH OR SURFACE MOUNTING IN ACCORDANCE WITH THE LOCATION TO BE INSTALLED. PROVIDE SCREW-ON TYPE COVERS. BOXES INSTALLED IN DAMP LOCATIONS SHALL BE OF WATERTIGHT CONSTRUCTION WITH GASKETED COVER AND CONDUIT HUBS. IN NO CASE SHALL BOXES BE SIZED SMALLER THAN AS INDICATED IN ARTICLE 370 OF THE NATIONAL ELECTRICAL CODE FOR CONDUIT AND CONDUCTOR SIZES INSTALLED.

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2. TOGGLE SWITCHES

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3. RECEPTACLES

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b. 20 AMPERE, 125 VOLT, DUPLEX, WEATHERPROOF: CROUSE HINDS WLDR-1 WITH GFI RECEPTACLE.

4. TELEPHONE OUTLETS

1.01 DESCRIPTION

A. THE DRAWINGS ARE BASICALLY DIAGRAMMATIC, UNLESS DETAILED DIMENSIONED DRAWINGS ARE INCLUDED, AND SHOW ONLY APPROXIMATE LOCATIONS OF EQUIPMENT, FIXTURES, PANELBOARDS, WIRING DEVICES, ETC.

B. WHILE THE GENERAL RUN OF ELECTRICAL FEEDERS, BRANCH CIRCUITS, CONDUITS, ETC. IS INDICATED ON THE DRAWINGS, IT IS NOT INTENDED THAT EXACT ROUTING BE DETERMINED THEREFROM. CIRCUIT DESIGNATIONS ON SINGLE LINE DIAGRAMS, ELECTRICAL SCHEMATICS, INSTRUMENTATION SCHEMATICS, PANELBOARD SCHEDULES AND IN THE FORM OF "HOME RUNS" ON BRANCHES INDICATE THE DESIGNATION OF THE BRANCH CIRCUIT, THE SIZE AND QUANTITY OF BRANCH CIRCUIT CONDUCTORS, THE BRANCH CIRCUIT OVERCURRENT DEVICE RATING AND THE PANELBOARD OR INTERCONNECTION BOX FROM WHICH THE BRANCH CIRCUIT IS SERVED, THESE DESIGNATIONS MAY BE MODIFIED SUBJECT TO FIELD CONDITIONS.

C. ALL EQUIPMENT AND ACCESSORIES AND ITS INTERCONNECTING PIPING, DUCTWORK, CONDUIT, ETC., SHALL BE INSTALLED IN SUCH A MANNER THAT AMPLE MAINTENANCE AND PASSAGE SPACE AND CODE REQUIREMENT SPACE/ACCESS WILL BE PROVIDED.

D. WHERE MORE THAN ONE TRADE IS INVOLVED IN AN AREA, SPACE OR CHASE, ALL SHALL COOPERATE AND INSTALL THEIR OWN WORK TO UTILIZE THE SPACE EQUALLY BETWEEN THEM IN PROPORTION TO THEIR INDIVIDUAL REQUIREMENTS.

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## PIPE INSULATION

1. ABOVEGROUND PIPING
  - a. THE INSULATION SHALL BE 2" THICK FIBERGLASS PIPE INSULATION AND CONFORM TO ASTM C547, ASTM C1136, AND NFPA 90A.
  - b. THE INSULATION SHALL HAVE A MAXIMUM THERMAL CONDUCTIVITY (K) OF 0.22 BTU-IN/HR-F<sup>2</sup>-F.
  - c. THE JACKETING SHALL CONFORM TO ASTM D374, ASTM E96, ASTM D882, ASTM 774, AND ASTM D781.
  - d. THE JACKETING SHALL BE EQUAL TO SARAN 560 VAPOR RETARDED FILM, MANUFACTURED BY THE DOW CHEMICAL COMPANY.

PUMP ENCLOSURE SHED UTILITY HEATER

1. THE ELECTRIC UNIT HEATER SHALL BE:
  - a. FAN FORCED.
  - b. 230V, SINGLE PHASE, 60 HZ.
  - c. CAPABLE OF 350 CFM.
  - d. AIR TEMPERATURE RISE OF 45°F.
  - e. EQUAL TO DAYTON MODEL #2YU62.
2. THE ELECTRIC UNIT HEATER SHALL BE CONTROLLED BY:
  - a. LINE VOLTAGE CONTROL.
  - b. SWITCH TYPE SPDT/SPDT.
  - c. CONTROL RANGE 30--110°F.
  - d. EQUAL TO DAYTON MODEL 1UHH2.

## PUMP ENCLOSURE SHED VENTILATION

1. EXHAUST FAN SHALL BE:
  - a. 7-INCH WITH BUG SCREEN AND GRAVITY SHUTTER.
  - b. 115V, SINGLE PHASE, 60 HZ.
  - c. CAPABLE OF 140 CFM @ 0.000-IN STATIC PRESSURE.
  - d. EQUAL TO DAYTON MODEL 1HKL9.
2. THE EXHAUST FAN SHALL BE CONTROLLED BY:
  - a. LINE VOLTAGE CONTROL.
  - b. SWITCH TYPE SPDT/SPDT.
  - c. CONTROL RANGE 30-110°F.
  - d. EQUAL TO DAYTON MODEL 1UHH2.
3. INLET LOUVER SHALL BE:
  - a. 10-INCH WITH BUG SCREEN AND GRAVITY SHUTTER.
  - b. EQUAL TO DAYTON MODEL 4C555.
4. THE INLET LOUVER SHALL BE OPERATED BY:
  - a. 120V, SINGLE PHASE, SHUTTER MOTOR.
  - b. EQUAL TO DAYTON MODEL 2C831.
5. THE SEQUENCE OF OPERATIONS SHALL BE SUCH THAT THE EXHAUST FAN AND INLET LOUVER SHALL NOT OPERATE WHEN THE HEATER IS ON.
6. THE SHED TEMPERATURE MONITOR AND ALARM SHALL:
  - a. BE A DUAL STAGE TEMPERATURE SWITCH.
  - b. PROBE RANGE OF -58 TO 302°F.
  - c. PTC THERMISTOR INPUT.
  - d. ONE 16A SPST RELAY @ 250 VAC, RESISTIVE, AND ONE 8A SPST RELAY @ 250 VAC RESISTIVE.
  - e. BE EQUAL TO SERIES TS22, MANUFACTURED BY DWYER.
7. THE SHED TEMPERATURE MONITOR PROBE SHALL:
  - a. BE A METAL PROBE.
  - b. HAVE A 10 FT CABLE.
  - c. BE EQUAL TO MODEL TS-61, MANUFACTURED BY DWYER.

## FREEZE-PROTECTED EMERGENCY SHOWER/EYEWASH

1. FREEZE-PROTECTED EMERGENCY SHOWER/EYEWASH CAPABLE OF PROVIDING A MINIMUM OF 30 GPM @ 30 PSI AT THE SHOWER AND 3.2 GPM AT THE EYEWASH. PROVIDE PEDESTAL STYLE UNIT.
2. SELF-LIMITING HEAT TRACE CABLE RATED AT 5 WATTS PER FOOT WITH 240 VAC POWER. ELECTRICAL COMPONENTS WILL BE RATED NEMA 4. PROVIDE A LOCAL HEAT TRACE INDICATOR LIGHT.
3. PROVIDE NEOPRENE CLOSED-CELL FOAM INSULATION WITH UNINHIBITED, REMOVAL, YELLOW ABS PLASTIC COVER.
4. WATER SUPPLY SHALL BE 1 1/4" DIAMETER BOTTOM CONNECTION.
5. SHOWER PIPING SHALL BE HOT DIP GALVANIZED SCHEDULE 80 STEEL PIPE MEETING ASTM-A53. PULL RING AND ROD SHALL BE MADE OF STAINLESS STEEL.
6. UNIT TO BE THERMOSTATICALLY CONTROLLED TO 60°F AND EQUAL TO ENCON THERMA-FLOW FREEZE-PROTECTED EMERGENCY SHOWER/EYEWASH MODEL #TF2A230000.
7. PROVIDE A FLOW SWITCH IN THE 1" DIAMETER WATER PIPE FEEDING THE EMERGENCY SHOWER. PROVIDE A NORMALLY CLOSED FLOW SWITCH THAT WILL ACTIVATE AN ALARM TO THE AUTODIALER UPON OPENING.

## SEQUENCE OF OPERATIONS

- ### A. NORMAL OPERATION

REFERENCE D-601 FOR DEVICE LOCATION IN PROCESS.

ALL ALARMS SHALL BE CLEAR TO BEGIN OPERATION.

THE EXTRACTION PUMP SHALL BEGIN OPERATION WHEN THE OPERATOR PRESSES THE RESET PUSHBUTTON ON CONTROL PANEL.

WHILE NORMAL OPERATION CONTINUES FLOW TOTALIZER FQ101A SHALL TOTALIZE THE QUANTITY OF PUMPED PRODUCT FROM INCEPTION. FQ101A SHALL NOT BE RESETABLE. FLOW TOTALIZER FQ101B SHALL TOTALIZE THE CURRENT BATCH PUMPED TO THE TANKS. FQ101B SHALL BE CONFIGURABLE AND RESETABLE BY THE OPERATOR.

- ### B. WARNING CONDITION

LAH102, LAH103, YAH110, YAH111, YAH112, TAH112 OR TAL112 SHALL INITIATE THE AUTO-DIALER WARNING CONDITION. WARNING CONDITIONS SHALL NOT SHUT OFF THE EXTRACTION PUMP. WARNING CONDITIONS SHALL NOTIFY OF PENDING STORAGE TANK FULL, TANK HEATER FAULT AND HIGH AND LOW TEMPERATURE IN PUMP ENCLOSURE SHED.

WHILE IN ALARM OR WARNING STATUS, THE AUTODIALER WILL CONTINUE TO CALL OUT UNTIL ACKNOWLEDGED.

- ### C. ALARM CONDITION

THE EXTRACTION PUMP SHALL CONTINUE TO OPERATE UNTIL ONE OR MORE OF THE FOLLOWING CONDITIONS EXISTS:

1. E-STOP IS PRESSED ON THE CONTROL PANEL IN PUMP ENCLOSURE SHED.
2. FQ101B REACHES THE BATCH SETPOINT. BATCH SETPOINT IS SET BY THE OPERATOR ON CONTROL PANEL.
3. PAH101 EXISTS. (LINE PRESSURE IS TO HIGH)
4. LAH101 EXISTS. (PUMP ENCLOSURE SHED FLOOR SUMP A HIGH LEVEL)
5. LAHH102 EXISTS. (TANK 2 IS IS OVERFILLED)
6. LAHH103 EXISTS. (TANK 1 OVERFILLED)
7. LAH104 IS ACTIVE. (HIGH LEVEL INTERNAL TO EXTRACTION PUMP HOSE BREAK)
8. HS105 IS OFF. (SWITCH LOCATED BETWEEN STORAGE TANKS IS MANUALLY TURNED OFF)
9. LAH109 EXISTS. (EXTRACTION WELL SUMP HAS A HIGH LEVEL)
10. FAL101 OR FAH101 EXISTS. (LOW OR HIGH FLOW OCCURS IN THE DAPL CARRIER PIPE LINE)
11. LAH107 EXISTS. (TANK 1 HAS A LEAK)
12. LH108 EXISTS. (TANK 2 HAS A LEAK)

EACH CONDITION ABOVE SHALL SHUTDOWN THE EXTRACTION PUMP AND INITIATES THE AUTO-DIALER ALARM CONDITION. THE SYSTEM WILL REMAIN INOPERABLE UNTIL ALL ALARM CONDITIONS ARE CLEAR AND THE RESET PUSHBUTTON ON THE CONTROL PANEL HAS BEEN ACTIVATED.

LAH107 AND LAH108 (INTERSTITIAL SPACE MONITOR FOR THE DAPL STORAGE TANKS) SHALL INITIATE THE AUTO-DIALER ALARM CONDITION. ALARM CONDITIONS SHALL SHUT DOWN THE EXTRACTION PUMP.

ALL WARNING AND ALARM SIGNALS SHALL PRODUCE PILOT LIGHT INDICATION ON THE FRONT OF THE CONTROL PANEL.

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						DRAWN: BDE	PROJECT NO: 6100-08-0016
C	09/08/08	100% DESIGN EPA SUBMITTAL	REO	BDE		ENGINEER: BDE	SCALE: NONE
B	09/03/08	ISSUED FOR CLIENT REVIEW - 100% DESIGN	REO	BDE		CHECKED: REO	APPROVED: PHT
A	08/05/08	ISSUED FOR CLIENT REVIEW - 45% DESIGN	REO	BDE		DATE: 08/05/08	DATE: 09/08/08
NO.	DATE	REVISIONS	BY	CHK			

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CHECKED: REO	APPROVED: PHT
DATE: 08/05/08	DATE: 09/08/08



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DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

## ELECTRICAL

### HEATER SPECIFICATIONS AND SEQUENCE OF OPERATIONS


DRAWING NO:

E-103

12 /

14



RP-1										Fully Rated		
VOLTAGE: 120/240V 1PH 3W				MAINS: 100A				Isc Duty: 10000				
FED FROM:DISCONNECT 1				LOCATION: SHED				MTG: SURFACE				
CIR. NO.	BKR SIZE	LOAD (VA)		DESCRIPTION	CIR. NO.	BKR SIZE	LOAD (VA)		DESCRIPTION			
		A	B				A	B				
1	20A	1000		DAPL PUMP	2	30A	2000		T-1 HEATER			
3	20A		1000	DAPL PUMP	4	30A		2000	T-2 HEATER			
5	30A	2500		HEATER	6	20A	1600		T-3 HEATER			
7	30A		2500	HEATER	8	20A		500	SHED RECPT			
9	20A	125		SHED LIGHTS	10	20A	1000		CONTROLS			
11	20A		1000	PC/RECPT	12	20A		500	CAMERA			
13	20A	125		EXTERIOR LIGHT	14	20A	125		E. SHOWER/ E. WASH			
15	30A		2400	HEAT TRACE	16	20A		125	E. SHOWER/ E. WASH			
17	30A	2400		HEAT TRACE	18	20A						
19	20A				20	20A		250	EXHAUST FAN			
21	20A				22	20A						
23	20A				24	20A						
TOTAL (VA)		6150	6900		TOTAL (VA)		4725	3375				
PANEL TOTAL		21150 VA (CONNECTED)						88.1 AMPS (CONNECTED)				

NOTES:

1. PROVIDE GFCI BREAKERS FOR T1 HEATER, T2 HEATER, T3 HEATER AND EMERGENECY SHOWER/ EYEWASH BREAKERS.

LIGHTING FIXTURE SCHEDULE:

CODE	LIGHT SOURCE		MOUNTING	MANUFACTURER	CATALOG NO.	VOLTS	DESCRIPTION
	TYPE	LAMPING					
A	FLUORESCENT	F32T8	CHAIN/PENDANT 8' AFF	COLUMBIA	LUN-42-32-120	120 VAC	4', 2 LAMP, ELECTRONIC BALLAST CORR RES, DAMP LOCATION, GASKETED FULL SPECTRUM
B	METAL HALIDE	100 WATT	SURFACE ON PIPE SUPPORT	HUBBELL	PVL-1004-128L	120 VAC	WALL PACK, 100 WATT, CORRES, COMPACT MULTITAP BALLAST, TAMPER RESISTANT, PHOTOCCELL
C	INCANDESCENT	5.4W KRYPTON	SURFACE	LITHONIA	ELM-DL	120 VAC	EMERGENCY LIGHT, DUAL HEAD, DAMP LOCATION

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NO.	DATE	REVISIONS	BY	CHK

DRAWN:	PROJECT NO:
BDE	6100-08-0016
ENGINEER:	SCALE:
BDE	NONE
CHECKED:	APPROVED:
REO	PHT
DATE:	DATE:
08/05/08	09/08/08



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DAPL EXTRACTION PILOT TEST  
OLIN CHEMICAL SUPERFUND SITE  
WILMINGTON, MASSACHUSETTS

ELECTRICAL  
PANEL & LIGHT SCHEDULES

DRAWING NO:
E-602
14
14